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60TH CONGRESS, 1st Session } HOUSE OF REPRESENTATIVES { DOCUMENT No. 492

REPORT OF

Examination of Ohio River

WITH A VIEW TO OBTAINING CHANNEL DEPTHS OF 6 AND 9 FEET, RESPECTIVELY

MADE BY A BOARD OF ENGINEERS
TRANSMITTED BY THE CHIEF OF ENGINEERS
WAR DEPARTMENT

WASHINGTON
GOVERNMENT PRINTING OFFICE
1908

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60TH CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 492.

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OHIO RIVER.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORT OF A BOARD OF ENGINEERS ON AN EXAMINATION OF THE OHIO RIVER WITH A VIEW TO OBTAINING CHANNEL DEPTHS OF 6 AND 9 FEET, RESPECTIVELY.

JANUARY 13, 1908.—Referred to the Committee on Rivers and Harbors and ordered to be printed with illustrations.

WAR DEPARTMENT,
Washington, January 11, 1908.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, U. S. Army, dated 10th instant, together with copy of report of a Board of Engineers, dated December 15, 1906, on examination of Ohio River with a view to obtaining channel depths of 6 and 9 feet, respectively, made in compliance with the provisions of the river and harbor act of March 3, 1905.

Very respectfully,

WM. H. TAFT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 10, 1908.

SIR: The river and harbor act approved March 3, 1905, in the item making appropriation for the further improvement of the Ohio River, contains the following:

The Secretary of War is hereby authorized and directed to appoint a board of engineers to examine the Ohio River, and report at the earliest date by which a thorough examination can be made, the necessary data with reference to the canalization of the river, and the approximate location and number of locks and dams in such river, with a view both to a depth of six feet and nine feet; and in said report shall include the probable cost of such improvement with each of

the depths named, the probable cost of maintenance, and the present and prospective commerce of said river, upstream as well as downstream having regard to both local and through traffic. They shall also report whether, in their opinion, such improvement should be made, and whether other plans of improvement could be devised under which the probable demands of traffic, present and prospective, could be provided for without additional locks and dams, or with a less number than is described in surveys heretofore made, giving general details relating to all of said plans and the approximate cost of completion thereof. They shall also examine the said river from the mouth of the Green River to Cairo, with a view to determining whether an increased depth can be maintained by use of dredges.

On May 12, 1905, by authority of the Secretary of War and in accordance with the provisions of the act just quoted, a Board of officers of the Corps of Engineers, consisting of Lieut. Col. D. W. Lockwood, Lieut. Col. Ernest H. Ruffner, Lieut. Col. Clinton B. Sears, Maj. George A. Zinn, and Maj. Wm. L. Sibert, was constituted by the Chief of Engineers and directed to assemble at Cincinnati, Ohio, at the call of the senior member, to carry out the purposes of the act. Capt. Harry Burgess, Corps of Engineers, was assigned to duty as recorder of the Board.

The Board made an inspection of the river, organized and conducted a hydrographic survey, and collected data and statistics from all available sources bearing upon the several features required by law to be reported upon. The report of the Board, dated December 15, 1906, is presented herewith for transmission to Congress. Its perusal will show how careful and thorough has been the work of the Board and to what degree of confidence the report is entitled.

Taking up in order the objects of inquiry specified in the law, the Board finds that a 6-foot navigation at low water can be established in the Ohio River from Pittsburg to Cairo by the construction of 45 locks with movable dams, at an estimated cost of $50,962,266 in addition to funds heretofore appropriated and authorized; that a 9-foot navigation over the same length of river can be established by the construction of 54 locks and dams, at an estimated cost of $63,731,488. The Board estimates the annual cost of maintenance at $15,000 for each lock and dam, making a total of $675,000 for the 6-foot project and $810,000 per annum for the 9-foot project. It should be noted, however, that these maintenance estimates do not take into consideration any dredging which may be found necessary in the pools. This subject will be considered later.

The Board gives exhaustive consideration to the question of present and probable commerce, both downstream and up, and it appears that the present commerce of the river is approximately 9,000,000 tons per annum, of which a large proportion is downstream. Having in view the fact that a canalized river offers an upstream navigation lower in cost and quicker in transit than an open-river project, the Board, arguing from the known natural resources of the section and its population, concludes that a river improved by this method will afford facilities for the cheap exchange of mineral, agricultural, and manufactured commodities, which from their low value and bulk can not be exchanged unless such cheap facilities are offered, and that there is every probability that the improvement of the Ohio River by canalization, as proposed, would induce a very large future commerce which does not now exist in addition to retaining and greatly facilitating and cheapening the commerce which the river now bears. The Board adverts to the probable opening of the ship canal, for which

Congress has recently given a national charter, from the lakes to the Ohio Valley and notes that an improved Ohio River will form a natural link in extension of this canal to all parts of the Ohio and Mississippi valleys.

The Board finds that the probable demands of traffic, present and prospective, can not be provided for by any other plan of improvement not having locks and dams, or having a less number of locks and dams than those proposed in the report.

The Board further finds that a 6-foot depth can be maintained by dredging below Green River, but that a 9-foot depth can not be maintained economically.

After careful discussion of the factors entering into the cost of transportation by water the Board finds that the probable cost per ton-mile for a 6-foot project will be 0.0653 cent, or 63.14 cents for a ton of coal delivered at Cairo from Pittsburg. For a 9-foot project the corresponding figures are 0.0447 cent and 43.25 cents, showing an economical advantage in the ratio of 3 to 2 in favor of the deeper project as compared with an increased cost ratio of 5 to 6 only. The estimated cost in both cases is materially increased by the necessity of making provision for the present unique method of coal transportation on the Ohio River, a method which has been developed by long experience, which has cut down the cost of transportation to a figure unprecedented in the history of commerce and which is apparently so well grounded on sound economical considerations that it can not and should not be disturbed. A project ignoring this method of transportation of coal and adapted to all other forms of traffic now found on the Ohio River or likely to be developed as a result of the improvement, could be devised on an estimated cost materially less than that herein presented, but such a project at a lesser cost does not appear to be admissible and is not considered.

The Board therefore finally recommends that the 9-foot project, involving 54 locks and dams at an estimated cost of $63,731,488, should be adopted.

As provided by law this report was referred to the Board of Engineers for Rivers and Harbors for review. This Board made a personal inspection of the river and held a public hearing at Pittsburg on August 12, 1907, at which hearing the representatives of the various localities interested in the proposed improvement furnished written statements in advocacy thereof. In its report [a] on this subject, dated October 18, 1907, the Board of Engineers for Rivers and Harbors, reviewing the former report in detail and submitting views differing somewhat on minor points from those expressed by the special Board, nevertheless coincides in the conclusions of that Board and recommends, without qualification, the improvement as proposed by that Board.

The Board of Engineers for Rivers and Harbors calls attention to the necessity for dredging in the pools as an item of maintenance and expresses the opinion that the maintenance cost of the special Board for the 9-foot project of about $800,000 per annum should be increased on this account to $1.000,000 per annum.

In transmitting this report of the special Board organized under the explicit mandate of Congress I think it important to emphasize certain unusual features of it and to comment upon the same.

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[a] See page 110.

It will be noted in the first place that, by a plain inference, the conclusions of the report depend upon a conjectural future commerce rather than upon the commerce now existing or plainly in sight. It is in fact an assumption of the restoration of the field of commercial usefulness which the river enjoyed before the advent of any rival method of transportation. It is assumed that commerce will always seek the route which it finds cheapest, cost and convenience considered, that by the method of improvement proposed the cost and convenience of commerce in both directions on the Ohio River can be made less than by any other method of transportation, and that under such conditions the traffic will surely seek the river. Attention is called by the Board of review to the fact that Congress has not up to this time sanctioned a project of such extent as this upon considerations of this character. Whether it ought to sanction either of these projects would appear to be a matter purely for legislative determination, based upon such data as are supplied by this report or as may be obtained by further inquiry. The original Board and the Board of review are both convinced that the probability of increased traffic is sufficiently strong to justify the proposed expenditure—this from the standpoint of ordinary business considerations—and from this standpoint I concur in this view. The question as to whether a step in advance shall be taken and whether this apparently good business proposition shall be made the basis of legislation for entering upon the improvement I prefer to leave to the wisdom of Congress.

On one point, however, my convictions are most strong and emphatic, and that is that there is no hope for success in the development of such a commerce as is predicated for the Ohio River by any other method of improvement than the one proposed. It is possible that a further study of the situation and a thorough revision of the project might reveal the possibility of reducing the number of locks and dams slightly and giving higher lifts to the latter, thus accomplishing better results at slightly decreased cost, but I entertain no doubt whatever that the development of a large future commerce, seeking the river in preference to other methods on account of the increased convenience and diminished cost of freight movement, depends absolutely upon a method of improvement which will have a tendency to remove or minimize the present vastly different conditions between upstream and downstream traffic. The unprofitableness of the upstream movement has always been a drag upon the downstream movement, whereas every increment of the upstream traffic on a profitable basis will have a tendency to decrease the cost and increase the amount of downstream traffic. The greatest disparity of conditions between the downstream and upstream freight movement resides in the current, which hampers both, though not equally.

The pronounced advantage of lake over river transportation is very largely the result of the absence of current in the former. It follows that a scheme of improvement of the Ohio River promising success must present as one of its features a diminution of current, which can not be attained in any appreciable degree by any open-channel method.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

REPORT OF A BOARD OF ENGINEERS ON EXAMINATION OF OHIO RIVER WITH A VIEW TO OBTAINING CHANNEL DEPTHS OF 6 AND 9 FEET, RESPECTIVELY.

LOUISVILLE KY., *December 15, 1906.*

GENERAL: The Board constituted by paragraph 1, Special Orders 17, Office of the Chief of Engineers, May 12, 1905, has the honor to make the following report:

The orders constituting the Board and detailing the recorder are—

SPECIAL ORDERS, No. 17.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, May 12, 1905.

Extract.

1. By authority of the Secretary of War and in accordance with the provisions of the river and harbor act of March 3, 1905, a Board of officers of the Corps of Engineers to consist of Lieut. Col. Daniel W. Lockwood, Lieut. Col. Ernest H. Ruffner, Lieut. Col. Clinton B. Sears, Maj. George A. Zinn, Maj. William L. Sibert, will assemble at Cincinnati, Ohio, upon the call of the senior member, to examine the Ohio River and report at the earliest date by which a thorough examination can be made the necessary data with reference to the canalization of the river and the approximate location and number of locks and dams in such river, with a view both to a depth of 6 feet and 9 feet; and in said report shall include the probable cost of such improvement with each of the depths named, the probable cost of maintenance, and the present and prospective commerce of said river, upstream as well as downstream, having regard to both local and through traffic. They shall also report whether, in their opinion, such improvement should be made and whether other plans of improvement could be devised under which the probable demands of traffic, present and prospective, could be provided for without additional locks and dams, or with a less number than is described in surveys heretofore made, giving general details relating to all of said plans and the approximate cost of completion thereof. They shall also examine said river from the mouth of the Green River to Cairo with a view of determining whether an increased depth can be maintained by the use of dredges.

The expenses of the Board are payable from the appropriation for "Improving Ohio River: General improvement."

The Board is authorized to visit such points as it deems necessary for the proper performance of its duties.

* * * * * * *

By command of Brig. Gen. Mackenzie:

FREDERIC V. ABBOT,
Major, Corps of Engineers.

SPECIAL ORDERS, No. 18.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 14, 1905.

Capt. Harry Burgess, Corps of Engineers, is hereby detailed, in addition to his other duties, as recorder and disbursing officer of the Board of officers of the Corps of Engineers, appointed by paragraph 1, Special Orders, No. 17, Office of the Chief of Engineers, May 12, 1905, to examine the Ohio River and report plans for the improvement of said river. Captain Burgess will report by letter to Lieut. Col. Daniel W. Lockwood, Corps of Engineers, senior member of the Board, for instructions.

By command of Brig. Gen. Mackenzie:

FREDERIC V. ABBOT,
Major, Corps of Engineers.

The act of Congress authorizing the appointment of the Board and designating its duties is as follows:

(PUBLIC—No. 215.)

An Act Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

* * * * * * *

The Secretary of War is hereby authorized and directed to appoint a board of engineers to examine the Ohio River, and report at the earliest date by

which a thorough examination can be made, the necessary data with reference to the canalization of the river, and the approximate location and number of locks and dams in such river, with a view both to a depth of six feet and nine feet; and in said report shall include the probable cost of such improvement with each of the depths named, the probable cost of maintenance, and the present and prospective commerce of said river, upstream as well as downstream having regard to both local and through traffic. They shall also report whether, in their opinion, such improvement should be made, and whether other plans of improvement could be devised under which the probable demands of traffic, present and prospective, could be provided for without additional locks and dams, or with a less number than is described in surveys heretofore made, giving general details relating to all of said plans and the approximate cost of completion thereof. They shall also examine the said river from the mouth of the Green River to Cairo, with a view to determining whether an increased depth can be maintained by use of dredges.

* * * * * * *

Approved, March 3, 1905.

On June 16, 1905, an allotment of $56,000 from the appropriation for "Improving Ohio River: General improvement" was made for the prosecution of the survey of the Ohio River and for the expenses of the Board; on January 3, 1906, an additional allotment of $9,646.20, and on November 2, 1906, an additional allotment of $2,500, were made from the same appropriation.

MEETINGS OF THE BOARD.

The Board held its first meeting on June 8 and 9, 1905, at Cincinnati, Ohio, at which meeting it was decided that a survey of the river from the mouth of the Big Miami to Cairo would be necessary and that such survey should be similar to that previously made of the river from Pittsburg to the mouth of the Big Miami, hereafter referred to. It was also decided to request the Chief of Engineers to detail an executive officer to conduct the necessary surveys and such other work as might be assigned to him. A second meeting was held at Pittsburg on October 16 and 17, 1905, when the Board made a thorough examination of the locks and dams on the Ohio in that engineering district. In October, 1906 (19 to 22), the Board went over the river from Louisville, Ky., to Cairo, Ill., on the Government steamer *Major Mackenzie*, traveling only during the daytime so as to examine this portion of the river at low water, especially that part below the mouth of the Green River. During this trip the Board was in practically a continuous session. Meetings were also held in Louisville on December 14 and 15, 1905, and August 16 and 17, 1906, the final meeting being held at Louisville on December 14 and 15, 1906.

The work of the Board was done chiefly by committees of from one to three members, the conclusions of the committees being reported at the meetings of the Board and there discussed by the full Board.

PHYSICAL CHARACTERISTICS OF THE RIVER.

From the junction of the Allegheny and Monongahela rivers, which form the Ohio, to the junction of the Ohio with the Mississippi at Cairo is a distance of 967 miles. With its tributaries it drains an area of approximately 210,000 square miles, having a population of about 12,000,000 inhabitants.

The discharge of the Ohio is constantly varying, but it may be said in general that the lowest stages occur in the months of August, September, and October, and the highest in February, March, and April, with occasional floods of short duration throughout the year. From 1832 to 1906 the highest stage occurred in one of the months between August and May, and the lowest between July and November. The highest recorded floods are given in the following table:

Place.	Low water on gauge.	1832.	1883.	1884.
Pittsburg	−1.30	33.33	27.75	33.25
Wheeling	.96	43.50	35.75	52.09
Marietta	1.67	49.00	43.67	52.09
Cincinnati	1.92	64.01	66.33	71.06
Louisville:				
Head of falls	1.70	40.76	43.80	46.70
Foot of falls	2.00	67.50	70.10	72.00
Evansville	− .30	46.29	47.80	48.80
		1867.		
Paducah	− .70	51.90	50.70	54.25
		1862.		
Cairo	−1.00	51.27	52.20	51.79

The duration in days of the various stages varies greatly from year to year. The following table shows the average number of days per year that the United States river gauges read 6 feet or over and 9 feet or over. The averages are from the records of ten years (1895 to 1904) except for Madison, Ind., and Louisville, Ky., below the falls, where the records are for five years (1900 to 1904):

River gauge station.	Miles below Pittsburg.	Number of days 6 feet or over.	Number of days 9 feet or over.
Davis Island dam	6.0	158.4	79.0
Dam No. 6	28.5	203.1	117.0
Wheeling, W. Va	90.0	200.5	119.2
Parkersburg, W. Va.[a]	183.5	238.3	140.8
Point Pleasant, W. Va	263.4	204.8	150.3
Portsmouth, Ohio	353.0	272.4	216.4
Cincinnati, Ohio	466.5	300.2	248.3
Madison, Ind	553.5	288.0	233.0
Louisville, Ky., head of falls	599.0	212.7	97.5
Louisville, Ky., foot of falls	601.25	283.8	230.0
Evansville, Ind	783.0	280.7	198.5
Paducah, Ky	919.5	252.1	203.6
Cairo, Ill	967.0	333.6	302.4

[a] Just below Parkersburg a dam confining the low-water discharge to one side of an island increases the number of days that a 6-foot stage is recorded. The effect of the dam is local and is not observable above a 10-foot stage.

This table indicates the following arrangement of reaches of river in the order of their present navigability:

Six feet or over.—(1) Portsmouth, Ohio, to Madison, Ind.; (2) below falls at Louisville, Ky., to Evansville, Ind.; (3) Evansville, Ind., to Cairo, Ill.; (4) Madison, Ind., to Louisville, Ky.; (5) Portsmouth, Ohio, to Parkersburg, W. Va.; (6) Parkersburg, W. Va., to Beaver, Pa. (Lock No. 6); (7) Beaver, Pa., to Pittsburg, Pa.

Nine feet or over.—(1) Portsmouth, Ohio, to Madison, Ind.; (2) below falls at Louisville, Ky., to Evansville, Ind.; (3) Evansville, Ind., to Cairo, Ill.; (4) Portsmouth, Ohio, to Parkersburg, W. Va.;

(5) Parkersburg, W. Va., to Beaver, Pa.; (6) Beaver, Pa., to Pittsburg, Pa.

All of the money necessary to complete the improvement from Beaver to Pittsburg, making a 9-foot depth, has been appropriated. By extending the present dam system at the head of the falls at Louisville across the river so as to provide a pool elevation of about 412.0 feet above sea level the reach of the river from Madison to Louisville will be navigable the entire year for boats drawing 9 feet and will connect Louisville with the present best navigable reach of the Ohio River. A study of the gauge records indicates that movable dams across the Ohio below Louisville, providing a 9-foot depth, would be operated 5 or 6 times a year; at Cincinnati 6.2 times a year, and between Wheeling and Pittsburg 14.5 times a year. Both partial and complete maneuvers of dam are considered in the above statement. The storage effects of the dams as the improvement of the river proceeds downstream from any point will, it is thought, control to some extent the moderate rise and prolong the length of the naturally navigable stages of the river below.

The slope of the low-water surface diminishes gradually from an average of 11.4 inches to the mile between Davis Island dam and Wheeling, W. Va. (85.3 miles), to 3.7 inches between Paducah, Ky., and Cairo (67 miles).

Between Pittsburg and Wheeling the bed of the river is coarse gravel and bowlders and sometimes rock. Below Wheeling the gravel becomes finer, the bowlders fewer, and bars of river sand appear. Below the mouth of the Kanawha the river becomes more distinctly a river with sand in bed, although there are some gravel bars above Louisville.

The average width between banks does not increase materially from Pittsburg to Cincinnati. In the long pool above the falls of the Ohio at Louisville the average width is much greater than that above Cincinnati, while just below the falls there is a considerable narrowing. Below this the average width continues to increase toward the mouth of the river. The maximum width between banks is about 20 miles from the mouth, where the width is considerably over a mile. There are many islands in the river, over 50 above Louisville and about 30 below, varying in size from a few acres to 5,000 acres. Many of them are cultivated and all are practically permanent in position.

The principal navigable tributaries of the Ohio are the Allegheny, Monongahela, Muskingum, Little Kanawha, Kanawha, Big Sandy, Kentucky, Green, Wabash, Cumberland, and Tennessee, on all of which the United States has undertaken works of improvement. Other important tributaries are the Beaver, Little Beaver, Big Hocking, Shade, Raccoon, Guyandot, Big Scioto, Licking, Big Miami, Salt, Saline, and Tradewater. The larger number and the more important of the tributaries enter from the south. It does not appear necessary to give in this place a detailed description of these tributaries or of the improvement works upon them because their improvement has no direct bearing upon the improvement of the Ohio except in so far as they influence the amount of traffic to be handled.

The Ohio River is a succession of natural pools formed by bars. Some of the bars are of gravel and some of sand, light or heavy, while

some, as at Beaver and Grand Chain, are formed by solid rock or hardpan shoals. The falls of the Ohio at Louisville, Ky., are formed by an irregular mass of limestone lying in the bed of the river. In their natural condition the falls or rapids were entirely impassable during the largest part of the year and at all times, except when the river was very high, navigation over them was difficult and dangerous.

Navigation in the Ohio is stopped not only by low stages of the river but also occasionally by ice, averaging ten to twelve days per year. The losses of steamboats, barges, and flatboats due to ice are at times very great. Sometimes the ice forms and passes off without occasioning serious loss; sometimes there may be more than one serious break-up during the same winter. There are a number of natural ice harbors along the river, the most valuable of which are the mouths of those tributaries not obstructed by bars, such as the Kanawha, Kentucky, Green, etc.

There are 27 bridges spanning the Ohio River, 15 of which were reported in December, 1903, by Col. G. J. Lydecker, Corps of Engineers, as obstructions to navigation by reason of insufficient width of channel span.

HISTORICAL.

In 1820 Congress made an appropriation for a survey of the Ohio River from Louisville to the Mississippi River and down that river to its mouth. This survey was made in 1821 by Captains Young and Poussin of the Topographical Engineers and Lieutenant Tuttle of the Engineers. In 1824 an appropriation of $75,000 was made for the improvement of certain sand bars in the Ohio and for the removal of snags from the Ohio and Mississippi rivers. During the following year, Maj. S. H. Long, Topographical Engineers, began the construction of the first dike on the Ohio at Henderson, Ky.

Under a charter granted by the State of Kentucky in 1825 a stock company constructed the Louisville and Portland Canal around the falls of the Ohio, which was opened for traffic in 1830. The United States was one of the original stockholders in this company and gradually increased its holdings until on February 8, 1855, all stock was owned by the United States except five shares held by the directors to qualify them to hold such office. These directors continued to manage the canal until the United States assumed control on June 11, 1874, purchasing the remaining five shares of stock. Between 1868 and 1873 the United States, although not managing the canal, made a series of appropriations for increasing its navigable capacity. Appropriations made since 1874 have been applied to its further improvement.

In 1830 work was begun on the removal of rocks at Grand Chain and dikes at Scuffletown, Sisters, and French and Cumberland islands were constructed in 1831 and 1832. The first permanent work above the falls was the dams at Browns Island, constructed in 1836. The construction of dikes and cut-off dams was in pursuance of the project of regulation of depths by closing island chutes and by narrowing the channel by dikes projecting from the bank in order to concentrate the water upon bars to cause their removal. This method of improvement was carried on at many places until the practical discontinuance of appropriations for the Ohio in 1844. From 1826 to 1844 appro-

priations were made for the improvement of the Ohio with approximate regularity, but from 1845 to 1866 only two appropriations were made, one of which was quite small and the other only $95,000. Upon the resumption of appropriations in 1866 the method of improvement by works of contraction was resumed, and, with the removal of snags, wrecks, and other obstructions and the cutting of channels by dredging through bars not regulated, this plan is still in use for practically the whole river. Ice harbors have also been constructed at various points above the falls.

While the method of improving the navigable channel of the river by means of dikes and cut-off dams was believed to be successful for the purpose of maintaining a minimum navigable depth of 3 feet, it was recognized at an early date that to provide for the accomodation of coal fleets the best method of improving the river, at least in the upper part of its course, was by means of locks and dams. The first recorded proposition for this purpose was made by Mr. W. Milnor Roberts, civil engineer, in 1870. In April, 1872, a Board of Engineers was appointed to examine and report upon the applicability of certain plans for movable hydraulic gates for chutes and locks. In 1874, Maj. W. E. Merrill, Corps of Engineers, recommended the construction of 13 locks and movable dams with Chanoine wickets between Pittsburg and Wheeling and stated that there is no doubt of the absolute necessity of using locks in any rational plan for improving the upper Ohio so as to secure a 6-foot navigation. In 1875 Major Merrill expressed himself in favor of extending the movable dam system throughout the entire river, qualifying his statement as to its applicability below the falls of the Ohio by saying that, although not assured of its serviceability there, it was a better system than one of permanent dams and the only other system promising 6 or 7 feet of navigation at low water, the system of dikes not being likely to afford more than 4 feet at extreme low water and then only after an immense development of such works. The river and harbor act of March 3, 1875, appropriated $100,000 "to be used for and applied towards the construction of a movable dam, or a dam with adjustable gates, for the purpose of testing substantially the best method of improving, permanently, the navigation of the Ohio River and its tributaries." This dam was constructed at Davis Island and was opened for traffic October 7, 1885.

The river and harbor act of August 11, 1881, directed the appointment of a Board of three Engineer officers whose duty it was to examine and report as to the feasibility and advisability of improving the Ohio River below Pittsburg by means of movable dams. This Board recommended the construction of four dams below Davis Island, No. 5 being just below the mouth of Beaver River. The first appropriation for the construction of this dam, now numbered 6, was made September 19, 1890. The lock was opened for traffic August 17, 1904, No. 2, 4¾ miles below Davis Island, being afterwards provided for and being completed in October, 1906. Appropriations for the construction of Locks Nos. 2 to 6, inclusive, have been made by the various river and harbor acts since 1890.

The act of June 3, 1896, authorizing a survey of the Ohio River from Pittsburg to Marietta, called for a report on "the number of movable dams necessary to improve said river between said points

to provide 6 feet of water therein at low water and the probable location of the necessary dams, as well as the probable cost thereof." This report (House Doc. 122, 55th Cong., 3d sess.) provided for a system of 18 locks between the points named, and appropriations were made as follows for beginning the construction of the locks and dams (Dams Nos. 1 to 6 having already been provided for as shown above): Dams Nos. 13 and 18, March 3, 1899; Dams Nos. 7, 8, 11, and 19, June 13, 1902.

The act of March 3, 1899, providing for a survey of the Ohio River between Marietta, Ohio, and the mouth of the Big Miami, states that the survey is to be made "with a view to the improvement of said river between said points by movable dams and otherwise so as to provide 6 feet of water in said river at low water, this survey to include a report upon the location of the necessary dams and the probable cost thereof." As this was in continuation of the previously authorized project the locks were given consecutive numberings. Appropriations for their construction were made as follows: Dam No. 26, March 3, 1905; Dam No. 37, June 13, 1902. Dam No. 37 corresponds with the lock to be located near Cullums Ripple referred to in the joint resolution of January 10, 1899.

The river and harbor act of June 13, 1902, provides for an examination at and below pool No. 1 in said river with a view of securing increased depth and additional harbor facilities for the city of Pittsburg. A Board of officers of the Corps of Engineers ordered to consider and report upon this matter was of the opinion that to meet the demands of traffic a depth of 9 feet should be provided from Davis Island (Lock No. 1) to Lock No. 7 (Annual Report, Chief of Engineers, 1903, Part 2, page 1693). The river and harbor act of March 3, 1905, appropriated funds for securing a stage of 9 feet in the pools made by Dams Nos. 2, 3, 4, 5, and 6 by a modification of those locks and dams. Further appropriation for this purpose was made by the sundry civil act of June 30, 1906.

SURVEYS.

The earliest survey of any part of the Ohio was that mentioned in a preceding paragraph, from Louisville to the mouth. In 1837 and 1838 a survey was made by Lieutenant Sanders, Engineers, from Pittsburg to Letarts, 234 miles; in 1844 this survey was continued downstream for 37 miles to Clippers Mills by C. A. Fuller, civil engineer, and in 1867 and 1868 the survey was completed from Clippers Mills to Cairo, 696 miles, by W. Milnor Roberts. The results of these surveys were compiled by Maj. W. E. Merrill, Corps of Engineers, in 1881, after being corrected from data of later surveys of special localities, and the maps were lithographed in 52 sheets and published. Special localities have been surveyed from time to time for use in connection with the general improvement of the river.

The river and harbor act of June 3, 1896, provided for a survey of the Ohio River from Marietta, Ohio, to Pittsburg, Pa., and for a preliminary examination from Marietta, Ohio, to the mouth of the river. The river and harbor act of March 3, 1899, provided for a survey from Marietta, Ohio, to the mouth of the Big Miami. The reports of these surveys and examination were made: (1) from Marietta to

Pittsburg by Maj. W. H. Bixby, Corps of Engineers, on December 28, 1898, published in House Document No. 122, Fifty-fifth Congress, third session; (2) on preliminary examination Marietta to the mouth, by Maj. W. H. Heuer, Corps of Engineers, on November 27, 1896, published in House Document No. 125, Fifty-fourth Congress, second session; (3) from Marietta to the mouth of the Big Miami, by Major Bixby, on January 14, 1902, published in House Document No. 336, Fifty-seventh Congress, first session. A joint resolution of January 10, 1899, provided for a preliminary survey at or near Cullums Ripple, immediately below the city of Cincinnati, Ohio, for the location of a lock.

In his report on the survey from Marietta to Pittsburg Major Bixby states, "at the time this special appropriation became available the Ohio River had already been surveyed from its head to below Beaver River, Pennsylvania, a distance of about 29 miles, and 6 dams, No. 1 (Davis Island) to No. 6 (Merrill), had already been specially provided for to insure a 6-foot low-water navigation over this length. * * * Consequently no further special survey was considered necessary above Dam No. 6, and the present report is therefore limited to the river below such dam." No description of the methods used in making this survey has been published, but it was probably made in a somewhat similar manner to the survey below the mouth of the Beaver. The field work of the survey from Beaver to Marietta was done during the low-water seasons of 1896 and 1897. The field work of the survey from Marietta to the mouth of the Big Miami was done during the low-water seasons of 1900, 1901, 1902, and 1903. These two surveys were essentially one, both being in charge of Mr. R. R. Jones, United States assistant engineer, and the same methods being used throughout. This combined survey covered the river from Beaver, Pa., to Gunpowder bar, 511.2 miles below Pittsburg, a distance of 482.2 miles, the line of precise levels and the low-water slope being extended to Louisville, Ky. The method of making this survey is described by Major Bixby in his report of January 14, 1902.

This Board at its first meeting on June 8 and 9, 1905, made a preliminary report [a] to the Chief of Engineers, in which it was stated:

> The Board is of the opinion that, in order to make the thorough examination called for and in a way commensurate with the magnitude of the undertaking involved, the survey of the river from the mouth of the Big Miami to Cairo should be made with the same degree of accuracy as that followed in the surveys already made from Pittsburg to the mouth of the Big Miami. It is estimated that such survey would cost $85,000. If this amount of money is not available for this purpose the Board can make the estimates with an approximate degree of accuracy from surveys covering a line of precise levels and sufficient soundings to show the low water and thread of the channel profiles and the development of bars, utilizing the Roberts and other surveys in connection therewith. The estimated cost of this survey is $50,000.

An estimate of $6,000 to cover all other expenses of the Board was also included. The second project for the survey was approved and an allotment of $56,000 was made in June, 1905; and on June 20 the recorder, Captain Burgess, was instructed by the Board, through the senior member, to submit a project for carrying on the survey, with number of parties to be put in the field, their organization, etc. Such project was submitted and approved July 6, 1905. Considerable difficulty was encountered in organizing parties on short notice,

[a] Not printed.

but the first party was organized and began work at the foot of the locks of the Louisville and Portland Canal, at Louisville, Ky., on August 7, the second party being organized later and beginning work on September 12 at Gunpowder bar, the end of the Marietta-Big Miami survey.

Mr. S. F. Crecelius, United States assistant engineer, was put in immediate charge of the entire survey. Party No. 1 consisted of (1) a base-line party, laying out and measuring base line, setting range stakes for sounding party, etc.; (2) precise-level party, running line of precise levels; (3) azimuth and witnessing party, obtaining and recording azimuth and witnessing angles at deflection points, mile points, and bench marks; (4) wye-level party, obtaining levels of water surface, setting water-slope stakes for sounding party, etc.; (5) sounding party, making cross-section lines of soundings at intervals of about 400 feet between lines; (6) necessary boatmen, men for general service, etc.; in all, 40 men. Party No. 2, or upper party, did not have to obtain line of precise levels nor run base line and was organized into (1) base-line party, locating and clearing base line of 1903 survey, running out shore line, and rerunning base line where previous base line was under water; (2) wye-level party, setting water-slope and range stakes for sounding party, obtaining level of water surface, etc.; (3) sounding party, making cross-section lines of soundings at intervals of about 400 feet between lines; (4) bench-mark party, locating and uncovering bench marks of 1903 survey; (5) necessary boatment, men for general service, etc.; in all, 26 men. The upper party completed the work to Louisville on November 7, 1905. The lower continued in the field until stopped by high water on December 2, 1905.

In June, 1906, two complete parties were organized, party No. 1 beginning work in the field on June 28, 1906, near Owensboro, where work was discontinued the previous fall, and party No. 2 beginning on June 28, 1906, at Caseyville, Ky. Each party was organized as follows: (1) base-line party, laying out and measuring base line; (2) precise-level party, running line of precise levels; (3) azimuth and witnessing party, obtaining and recording azimuth and witnessing angles at deflection points, mile points, and bench marks; (4) range-line party, setting range stakes and water-slope stakes for sounding party, running auxiliary base lines on islands, etc.; (5) wye-level party, obtaining level of water surface; (6) sounding party, making cross-section lines of soundings at intervals of about 600 feet between lines; (7) necessary boatmen, men for general service, etc.; in all, in the two parties, 100 men. The upper party completed its field work on September 7, 1906, and the lower party on September 8, 1906. Temporary gauges, about 20 miles apart, within the limits of the survey, were established and read twice daily during the progress of the work. Unfortunately the low-water seasons of both 1905 and 1906 were quite unfavorable for survey work, not only interfering with its progress but absolutely preventing the establishment of the exact low-water slope. It is intended to reestablish these temporary gauges as soon as favorable low-water stage occurs and to obtain thereby necessary data to determine accurately the low-water slope. A force is now engaged in office work in connection with the survey.

The methods used in this survey are essentially the same as described by Major Bixby except that no topography was taken and

the lines of soundings were farther apart than for Major Bixby's surveys, these changes being made necessary by lack of sufficient funds. The present survey is plotted on a scale of 1 inch equals 200 feet (1:2,400) for the part of the river from Gunpowder bar to the mouth of the Green River and on a scale of 1 inch equals 400 feet (1:4,800) from mouth of the Green River to Cairo, the smaller scale being necessary for the lower part because of the great widths of the river. The sheets for the part below Louisville are in pencil only, but it is intended to continue the office work until all the drawings and other records of the survey are completed. A complete profile showing the profile of the river bottom along the channel line and the low-water slope has been prepared for the entire river from Pittsburg to Cairo, the horizontal scale being 1 inch equals 5,000 feet and the vertical scale being 1 inch equals 4 feet. On this profile, which is included in this report, the location of locks and dams existing or under construction is shown with their pool surfaces, as well as the locks and dams proposed for both the 6-foot and 9-foot projects with their pool surfaces. The true low-water slope is shown on this profile for that part of the river above Louisville, while for the part below the profile shows an approximate low-water slope, determined by taking the lowest readings for 1906 on the temporary gauges and reducing proportionally by comparisons with the low-water readings of 1904 on the permanent gauges at Louisville, Evansville, Paducah, and Cairo—the only permanent gauges on this part of the river. The profile therefore shows the total low-water difference in elevation between Louisville and Evansville, between Evansville and Paducah, and between Paducah and Cairo, but does not show exactly the slope between.

To summarize, the maps and profiles on which plans and estimates in this report are based are prepared from the results of the surveys, (1) from Pittsburg to mouth of Beaver River, about 29 miles, made in 1893; (2) from mouth of Beaver to Marietta, about 142.25 miles, made in 1896 and 1897; (3) from Marietta to Gunpowder bar, about 340 miles, made in 1900, 1901, 1902, and 1903; (4) from Gunpowder bar to Cairo, about 457.25 miles, made in 1905 and 1906 (precise levels and low-water slopes from Gunpowder bar to Louisville made in 1903). The total length of the river as given above is 968.5 miles, which distance is measured along the base line and does not therefore exactly agree with the length of river measured along channel line. The distances given on profile are those measured along base line.

PRESENT COMMERCE OF THE OHIO RIVER.

The sources of information for obtaining reliable statistics showing the present commerce of the river are very limited. An act of Congress approved February 21, 1891, contains the following clause:

> that owners, agents, masters and clerks of vessels arriving at or departing from localities where works of river and harbor improvements are carried on shall furnish, on application of the person in local charge of the works, a comprehensive statement of vessels, passengers, freight and tonnage.

Under this act commercial statistics are collected at the Davis Island dam and the Louisville and Portland Canal and at the various locks and dams of the tributaries—the Allegheny, Monongahela,

Muskingum, Little Kanawha, Kanawha, Kentucky, and Green. The records kept at these places make no distinction between local and through freight, that is to say they do not give the places of origin and destination. There is a vast amount of traffic on the Ohio which does not touch at any of the points named and is not therefore recorded in any Government office, although the engineer officer in charge of the general improvement of the Ohio secures a more or less complete statement of traffic for the greater number of Ohio River boats, transportation companies, etc. Information as to local traffic can be obtained from vessels and wharf-boat owners, mayors of towns and cities, manufacturers, and shippers, although as a rule these do not keep exact records of shipments and receipts. There is also another difficulty in collecting statistics from manufacturers and others in their dislike to disclose what appears to them to be a confidential feature of their business.

The Steamboat Inspection Service of the Department of Commerce and Labor requires vessel owners to report monthly to the local inspectors the number of passengers carried. The local inspectors on the Ohio are located at Pittsburg, Pa., Wheeling, W. Va., Gallipolis, Ohio, Cincinnati, Ohio, Louisville, Ky., and Evansville, Ind. The surveyors of the port of the various ports of entry along the Ohio, viz, Pittsburg, Wheeling, Cincinnati, Louisville, Evansville, Paducah, and Cairo, keep a record of registered and licensed vessels with their tonnage and the nature of the business in which they are engaged.

In view of the above, it will be seen that under the present laws a full and complete statement of the Ohio River commerce can not be obtained from the sources of information specified, and the Board does not believe that the great cost of obtaining the necessary information by the employment of agents at the various points of shipment would be justified or successful. It was therefore decided to prepare statistical tables covering information from all of the above sources and to supplement this by the collection of statistics by the local district engineer officers and by the Ohio Valley Improvement Association, this society having offered its services for this purpose. The society undertook to report on the river freight movement at all towns and cities on the Ohio except Cincinnati, Wheeling, Pittsburg, and Louisville. For Cincinnati Capt. J. F. Ellison, secretary of the Ohio Valley Improvement Association, agreed to collect the information desired, and for the other three cities the collection of information was assigned to the local district engineer officers. The scope of the information to be obtained in these four cities covered not only the statistics of present commerce but also the prospective commerce, and, in order to remove the matter as far as possible from mere conjecture, it was decided to limit inquiries to the following points: (1) Total outgoing and incoming tonnage of freight; (2) the chief industries of the cities; (3) the sources of supply of raw materials used in these chief industries; (4) quantity of imported raw materials; (5) the effect upon manufacturing industries of uninterrupted navigation on the river; (6) present receipts and shipments by river.

The leading manufacturers and business men of the four cities, as well as the boards of trade, chambers of commerce, and other commercial bodies, were requested to express their opinions and to furnish

such other information as they possessed on the points mentioned. All information collected by the Board from the various sources mentioned is shown in Appendix I, Tables 1 to 8. All letters received from manufacturers, merchants, boards of trade, and others expressing an opinion in regard to the improvement of the Ohio are inclosed with this report. In the opinion of the Board it is desirable to print with this report only a few of the most representative of these letters, and, accordingly, those containing the most information are included in Appendixes II and III to this report,[a] the remaining letters being simply inclosed herewith. The thanks of the Board are due to the Ohio Valley Improvement Association and to its secretary, Captain Ellison, for their assistance in the collection of commercial statistics.

RIVER TRANSPORTATION.

Before the advent of railroads the greater portion of long-distance interchange of commodities among the people of the country was effected by means of waterways, both natural and artificial. This commerce, dependent on natural waterway transportation, was forced to accommodate itself to the intermittently navigable stages of the rivers.

From the beginning the railroad was a reliable system of transportation, and this reliability caused a gradual transfer to it from the intermittently navigable streams of the shipment of the more expensive grades of commodities—commodities that could stand a high freight rate and which demanded sure delivery in a reasonable time.

As the railroad, paralleling the intermittently navigable stream, increased in efficiency it continued to take from that stream the transportation of articles of less and less value, until finally there was generally left to the stream only the handling of the cheaper, bulkier commodities, like coal, the original cost of which was small and the loss consequent upon holding same in boats until the river reached a navigable stage was also small.

Whether or not transportation of the higher grades of freight was taken entirely from a river depended on the frequency and duration of its navigable stages. For instance, on the Ohio River such transportation, as shown by the packet trade, is continued with fair remuneration from Cairo to Evansville, Evansville to Louisville, and Louisville to Cincinnati, in so far as commerce that originates on the river and destined for river points is concerned. From Cincinnati to Pittsburg such method of transportation is carried on intermittently for about twenty-two weeks a year and barely exists as a paying proposition, and this notwithstanding the fact that such packets charge less than the railroads for similar service between Pittsburg and Cincinnati and deliver the freight more quickly during navigable periods.

There seems to be no proof that the proportional decrease in the use of streams for general transportation is due to any other cause than the unreliability of such streams for such purpose in their unimproved condition. This assumes, of course, that railroads will prorate with river lines of transportation where the latter are reliable, and thus not burden freight seeking water transportation with a high local rate to and from the river, and that the larger shippers have

[a] See pages 52 and 66.

no interest in one system of transportation over another and will route goods as the buyer desires, and that elevators and other auxiliaries to transportation are independent and equally available for all systems at the same price. (See letters from Cincinnati Packet Company, etc., Appendix II, Nos. 1 and 2.)[a] Unreliability of river transportation has prevented the proper development of wharves, loading, and unloading devices, and the larger shippers of finished products have prepared for shipping only by rail, adding to the disadvantages that the intermittent river transportation is forced to bear.

The existence of the present business of selling Pennsylvania, West Virginia, and Kentucky coal in the lower river markets is mainly due to river transportation; the railroads do not at present haul coal by rail from the Pennsylvania coal fields to Cincinnati, Louisville, and New Orleans, nor from the West Virginia coal fields to Louisville and New Orleans, nor from Kentucky coal fields to New Orleans in competition with other coal fields and other systems of transportation.

The problem of supplying these markets with coal by means of intermittently navigable streams has developed in the Ohio and Mississippi rivers one of the most efficient systems of inland water navigation in the world, a system in which towboats and barges are used. The steamer *Sprague* tows to market from Louisville to New Orleans sometimes as much as 60,000 tons of freight at one trip. The *Kaiserin Auguste Victoria*, one of the largest ships afloat, has a freight tonnage of 25,000 tons. The horsepower of the *Sprague* is 2,175, that of the *Kaiserin Auguste Victoria* is 17,200, and that of sufficient railroad locomotives to haul the *Sprague's* cargo on an average grade road, 24,000. While the horsepower hours are the true test, still the possibilities of a permanent river transportation system (where downstream traffic predominates) using towboats and barges, are indicated by this comparison. The fact that there has come into existence under present conditions the transportation equipment now on the Ohio has an important bearing in estimating the value and reliability to be expected in the boat service on an improved river.

An extremely low possible downstream freight cost on the Ohio should have a material bearing on the ability of the manufacturers in such valley to export and sell their iron, steel, and other products in the world's markets, the ability to sell abroad being dependent not only on the ability to bring together cheaply the raw material essential to manufacture but on the ability to cheaply place the manufactured article in the world's markets.

Fleets similar to those now in use, if navigable depths existed at all times, would frequently and regularly pass a given point and would be available for manufacturers and shippers for the movement of any barges that may be loaded and ready to start for points of destination, whether for short or long distances, there being nearly always long-distance coal traffic. Smaller producers of merchandise would therefore not be called upon to build and operate expensive steamboats in order to share in the advantages of towboat transportation, although no doubt large producers in some cases would elect to do their own towing.

It has been estimated that a transportation company having as much as 3,500,000 tons of low-grade freight to transport from Pitts-

[a] See pages 52 and 53.

burg or lower points on the Ohio to New Orleans, this freight offering in thousand-ton lots and with regularity sufficient to keep the plant moving at all times except during extreme floods and for a few weeks in the year when ice may interfere, could transport on a 9-foot depth such freight as coal at a price not to exceed 0.5 mill per ton-mile and return the empty craft to its original location. This price includes maintenance and 5 per cent interest on investment and is about one-eighth the average rail rate on similar commodities. (See tables of freight rates, Appendix II, Nos. 3 and 4.)[a]

Time that goods are in transit, river and rail.—There seems to be a misconception as to the time required to deliver goods by river in comparison with that required to deliver them by rail. It can safely be stated that under present conditions when a navigable stage may be relied upon shipments of less than carload lots are generally delivered by river in less time than similar shipments are delivered by rail, and that on a reliable stream nearly all classes of freight offering in any quantities are delivered at least as quickly by river as by rail. The only exception is where freight is offered in train-load lots every day, so that such train can be scheduled for daily service in the same manner as passenger trains. This system is adopted in shipment of coke from the Connellsville district to Chicago, a daily demand being supplied by special train-load lots. This same system of shipment is applicable to the transportation of perishable fruits from the Pacific to the East and of live stock. With these exceptions, under present conditions of rail service, it is thought that the time of delivery will generally be less by water than by rail it matters not what the distance may be. The reported average movement of a loaded freight car per day in the United States is about 23 miles. (See extract of Interstate Commerce Commission's Report, 1904, Appendix II, No. 5.)[b]

The packet, which takes the place of the local freight and passenger train, averages, when navigable depths are always available, about 120 miles per day, including stops, loading, and unloading of freight. A towboat leaving Pittsburg, for instance, with loaded barges destined for Cincinnati, Louisville, and New Orleans, will deliver such barges at Cincinnati in four or five days, at Louisville in five or six days, and at New Orleans in sixteen to eighteen days; distances, Pittsburg to Cincinnati 468 miles, to Louisville 598 miles, to New Orleans 2,020 miles. The return of the towboat and empties to their original location will not vary materially from the time consumed in delivering the loaded barges, this being due to the fact that a considerable portion of the barges will be light on the return trip and that the rate of travel downstream is small in consequence of the necessity of flanking points and backing in order to properly navigate the fleet. It is thought that the round-trip time will be approximately the same for a canalized as for an open river.

Types of boats best suited to river traffic.—Two distinctive types of boats exist at present upon the Ohio River—the packet boat and the towboat. The packet boat is a freight and passenger steamer that corresponds to the local freight and passenger train and its use is indicated in a community where small shipments are made and many landings necessary. Where commodities offer in from 200 to 1,000 ton lots or reach their destination in such lots, the use of a towboat with barges is indicated if there is business sufficient.

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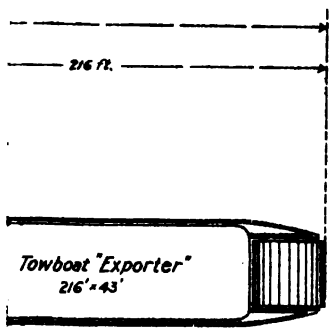
[a] See pages 53 to 58. [b] See page 58.



U. S. BOARD OF ENGINEERS
on Improvement of the Ohio River,
(Instituted by S. O. 17, Office, Chief of Engineers, May 12, 1905.)

To accompany report of Dec 15. 1906.

THE NORRIS

H. Doc. 492 60 1

NO. 1. DEPARTURE OF COAL FLEETS FROM PITTSBURG, PA.

No. 2. Departure of Coal Fleets from Pittsburg, Pa.

No. 3. Model Barges for Shipment of Manufactured Steel, etc.

A direct relation exists between the draft of single boats and economy of transportation by such boats. In shallow rivers the only way to increase materially the amount of cargo is to increase the area covered by such cargo; this requirement indicates a towboat and barge system. There is a depth, however, where the economical transportation of freight offered in large lots indicates the desirability of using single boats. It is problematical just what this depth is. It is thought, however, that this depth can not be maintained in the Ohio River for the transportation of cheap commodities over long distances. The single boat will, it is thought, find a useful place on the improved river. The economical length of run, the kind of boat, and the character of freight transported will no doubt be determined by experience. (See Comparative rates, rail and packet, long and short hauls, Appendix II, Nos. 6 and 7.)[a]

In downstream towing in contracted channels where currents of considerable velocity are encountered the experience on the Ohio and Mississippi rivers indicates that the stern-wheel steamboat has no equal for the performance of this particular work. The larger stern-wheel towboats on the Ohio River are equipped with from three to five balanced rudders. These rudders are from 20 to 30 feet long, shaped to the bottom of the boat, extend forward of the rudder post and project to the rear several feet beneath the stern-wheel. When the stern-wheel is reversed a strong current is deflected against the long rudder blades, thus facilitating steering, it matters not whether the boat be still or moving.

A stern-wheel steamboat of about 1,000 horsepower will ordinarily leave the headwaters of the Ohio on suitable stages of water for southwestern points with a tow consisting of about 12 coal boats and 3 barges, arranged as shown in diagram No. 1. After passing the Bellaire bridge, 96 miles below Pittsburg, 5 more coal boats will ordinarily be added to this tow, making a total of 17 coal boats and 3 barges, the cargo of which will be about 18,500 tons. Ordinarily this boat will proceed with the above tow to Louisville, Ky., and, after passing through the canal, will deliver its tow to a larger boat. From the canal at Louisville to New Orleans a boat of the most powerful class will tow from 30 to 60 coal boats, each boat being loaded with about 1,000 tons of coal or other similar commodities. Diagram No. 2 shows one of the largest towboats hitched into the tow that she will propel from Louisville to New Orleans. Photographs herewith show departure of coal fleets from Pittsburg and model barge for shipping manufactured steel.

PROSPECTIVE COMMERCE ON AN IMPROVED RIVER.

In order to estimate the benefit which will accrue to the valleys of the Mississippi and Ohio river system by the improvement of the Ohio River, it is not only necessary to discuss the kinds and quantities of freight carried on the present unimproved streams and the great increase in such kinds of freight which will occur upon a safer and more dependable waterway, but it is also necessary to investigate the mineral, agricultural, and commercial resources of the system with a view to estimating the effect which cheap local and through transportation will have upon the development of new industries.

[a] See pages 58 and 59.

It is rare indeed that a location for a large manufacturing esta lishment can be found where all the basic materials necessary to t manufacture of finished products exist in abundance. A manufactu ing establishment is therefore usually located at some point whe can be found the basic material of which it uses the greatest tonnag If this location be at a point to which the other basic materials can brought cheaply we have a good manufacturing site, assuming, course, that the output can be carried to the market cheaply.

A prediction, therefore, as to that portion of the prospective com merce dependent upon the development of new industries caused b cheap transportation would involve investigations thought not to b contemplated in the instructions to the Board. The extent of suc investigations is indicated by the fact that the Ohio River in its de scent from Pittsburg to Cairo meets the rock exposures of severa thousand feet thickness of the earth's crust at that locality where suc rock strata abound most with materials useful and some indispensabl to mankind. (See Appendix II, No. 8.)[a] These materials in thei natural state are in many cases of low intrinsic value and their use i manufacturing is consequently dependent on cheap transportation Every marked step in cheapening the cost of transportation and i making it reliable will cause new industries to develop, utilizing cheaper grades of raw material.

Prospective downstream commerce.—It is thought that the volum and tonnage of downstream traffic, including coal which is all down stream, will be very much more than that of the upstream traffic, al though the value of upward bound southern commodities, ton for ton will probably average higher. Instances will occur, however, where the prospective value of down stream traffic will be very high. Take the case of tobacco from Kentucky, which State ships from its borders more than 100,000 tons annually, much of which ultimately reaches a European market.

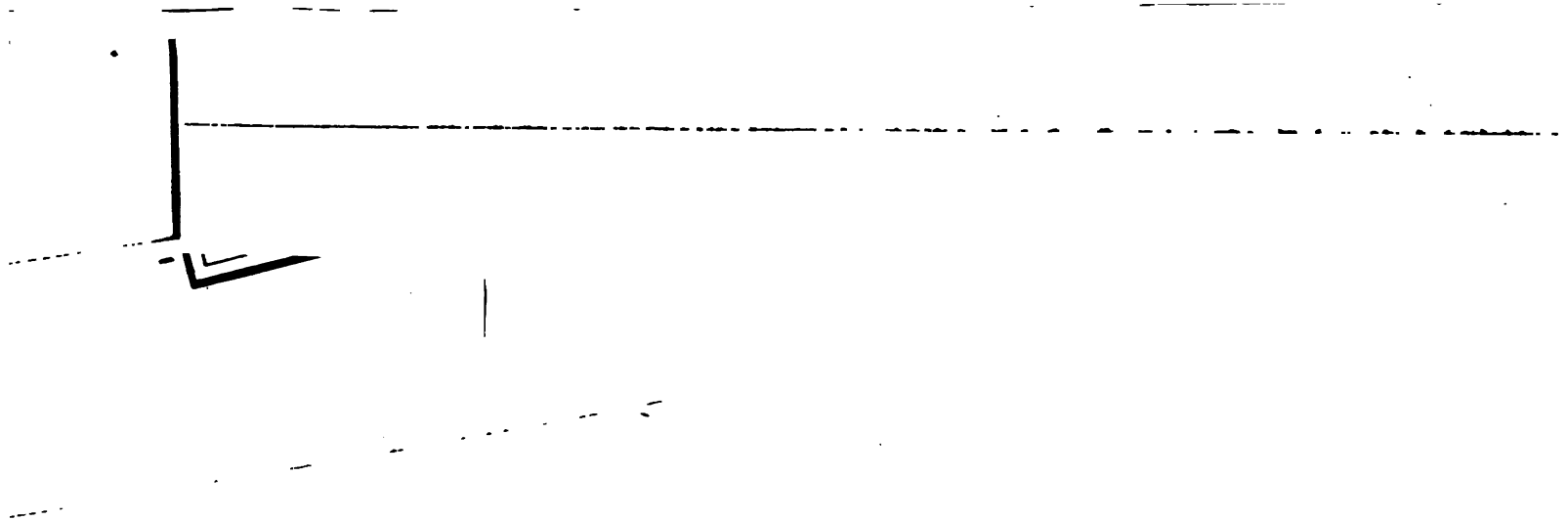
Again, extensive potteries of East Liverpool, Ohio, reported to be the largest in America, can distribute their wares in the remote South and in some of their specialties control to a great extent the traffic of the entire Gulf region, owing to the ability to reach tidewater at New Orleans with goods in bulk at a rate of about $3 per ton from point of manufacture to New Orleans, a distance of about 2,000 miles, while there is now paid about $14 per ton for each 1,000 miles of rail distribution of such commodities.

At Midland, Pa., 37 miles below Pittsburg on the Ohio River, is now being built a large steel plant in anticipation of slack water. This establishment expects to receive its coking coal, ultimately amounting to about 2,000,000 tons annually, via the Ohio River, and to ship 25 per cent of its finished product, ultimately about 150,000 tons a year, by river. (See Appendix II, No. 9.)[a]

The Jones & Laughlin Steel Company have just purchased 4 miles of Ohio River frontage 20 miles below Pittsburg and purpose to immediately erect large steel plants at that point, and this is due to the expectation that the river from Pittsburg to Beaver will be available for reliable navigation within the year 1907 and is in anticipation of a future use of the lower river for exports.

Letters from the Carnegie Steel Company, American Steel and Wire Company, Jones & Laughlin Steel Company, and American

[a] See page 60.



Sheet and Tin Plate Company (see Appendix II, Nos. 10, 11, 12, and 13)[a] indicate a large expected use of the improved river for through shipments of manufactured steel and iron to the South and Southwest and to New Orleans for export and for shipment to the Pacific coast.

Through the exertions of the transcontinental railroads there have been developed in the Middle South and Central States manufacturing establishments that now supply many of the wants of the Orient and the Pacific coast. The commodities are shipped by rail from such cities as Pittsburg, Cleveland, Detroit, Cincinnati, Chicago, and St. Louis to towns on the Pacific coast for use there or for export. It is interesting to note the following list of articles which were recently transported in a 12,000-ton American ship outward bound from Tacoma and Seattle for Yokohama, Kobe, Moji, Shanghai, Hongkong, and the Philippines:

Bicycles.	Cotton clothes.	Paints.
Books.	Drugs.	Paper (in bales).
Bridges (steel).	Electric machinery.	Pianos.
Building paper.	Flour.	Piles.
Canned meats.	Furniture.	Pipe (iron).
Canned oysters.	Hay.	Potatoes.
Castings.	Lard.	Railway cars.
Cedar poles.	Locomotives.	Rifles.
Cigarettes.	Malted milk.	Roots.
Condensed milk.	Nails.	Salmon.
Copper ingots.	Oats.	Spikes.

The greater amount in both value and tonnage of the items enumerated in above list is, or can be, produced in the Ohio Valley, and a great increase in the trade should be looked for in consequence of the marked reduction in freight cost from point of manufacture to market, both on the Pacific coast and in the Orient, which will occur when the Isthmian Canal is completed and a reliable waterway is created in the Ohio and Mississippi valleys.

It is a matter of interest to the Southern cotton grower that more than half the cotton shipped from this country to Japan is exported from southern California points after a travel of 2,000 miles by rail in order to reach such points.

Practically every site on the Ohio River within 30 miles of Pittsburg available and suitable for a large manufacturing plant has been purchased for such use. In this reach of river a 9-foot navigable depth is authorized and nearly completed. While it would not be fair to assume that this condition would follow the entire canalized reach as improvements progress downstream, it indicates a remarkable consequent development, the products of which will seek a market South and Southwest in this country and in the Orient and furnish downstream traffic for an improved Ohio.

It is thought that there will be a great increase in the downstream movement of coal, both locally and through, from the valleys of the Ohio and its tributaries, thus making New Orleans an attractive coaling station and a great port for the export of downstream traffic of the Ohio and Mississippi rivers and the import of many commodities that could be advantageously transported upstream on these rivers.

Prospective upstream commerce.—Several barges of sugar were transported from New Orleans to Pittsburg during the winter of 1905–6 by means of towboats on their return trip after delivering coal to New Orleans, for which a charge of 1.14 mills per ton-mile was

[a] See pages 61 and 62.

made, or about $2.30 per ton from New Orleans to Pittsburg, a distance of 2,020 miles. The rail rate for this shipment would have been $6 per ton. (See Appendix II, Nos. 14 and 15.)[a]

To obtain some idea of the effect an improved Ohio would have on through up-bound traffic composed of imported products and products of the Gulf States a map has been prepared of the eastern and central portions of the United States. This map shows the boundary of a territory which from a combined river and rail freight transportation standpoint is tributary to the Ohio and Mississippi rivers system. (See map No. 1.) In the preparation of this map the assumption was made that southern and tropical products and many classes of imported articles could be placed f. o. b. barges at New Orleans for the same cost that they could be placed f. o. b. cars at New York or other Atlantic coast towns.

The boundary line of this territory was found by drawing a line through towns to which the freight rate from New Orleans by river and rail at present rates is equal to the present all-rail rates from seaport towns to the same points. Barge freight rate from New Orleans to distributing points such as Vicksburg, Cairo, Evansville, Louisville, Cincinnati, Wheeling, and Pittsburg was assumed at 1.14 mills per ton-mile, which was the rate charged during the year 1905–6. The rail rate used was 4.832 mills per ton-mile from Gulf cities northward and is the present mean ton-mile rate on sugar in carload lots from New Orleans to Chicago, Cincinnati, Louisville, and Pittsburg. The rate used from Atlantic coast cities inland is that of the Pennsylvania Railroad from New York to Pittsburg, or 7.4 mills per ton-mile, which is the mean of the ton-mile rate on sugar and rice. (See Appendix II, No. 16.)[b] A rate of 2 mills per ton-mile was used on the Hudson River and through the Erie Canal and a rate of 1½ mills per ton-mile on the Great Lakes for such commodities as sugar, rice, etc.

Within the territory shown on the map now lives a population of about 20,000,000 people, 8,504,000 of whom live in that portion of territory lying in the Ohio Valley proper. The population of the entire territory in question will consume annually about 700,000 tons of the four following products: Rice, sugar, coffee, molasses. The population of the Ohio Valley proper within this territory will consume about 300,000 tons, and it seems fair to assume that with an improved river the wholesale transportation of this and other upstream tonnage, together with a share of all imports, will be partly accomplished by the Mississippi and Ohio rivers, or at least freight rates will be controlled thereby.

In support of the fairness of the assumption of 1.14 mills per ton-mile as the cost of the upstream transportation in barge lots on an improved Ohio River, attention is invited to the following brief mention of Gray's Iron Line, which line operated on the Ohio and Mississippi rivers, to traffic on the Rhine in 1903 and to the upstream freight movement on the Volga River in Russia:

During the twenty-seven years between 1864 and 1891 a fleet of seven steamers and numerous 500 to 1,000 ton barges, known as "Gray's Iron Line," was in successful operation carrying iron ore from Missouri to Pittsburg, returning with coal and manufactured steel and iron to St. Louis. The line was operated as long as the

[a] See page 63.

[b] See page 64.

NOVA ZEMBLA

ore fields in Missouri could be profitably worked. The greater portion of the ore was loaded at Sulphur Springs, Mo., about 160 miles from Cairo, which distance added to the 967 miles upstream distance via the Ohio to Pittsburg, made 1,127 miles of movement for the ore. The freight rate averaged about $1.75 per ton, or about 1.5 mills per ton-mile, which included loading the ore by hand.

It is reported that the Rhine River in Germany had in 1903 an upstream traffic of 10,027,900 tons and a downstream traffic of 7,211,900 tons. The freight cost in 1,000-ton barges was approximately 1.11 mills per ton-mile, counting both up and downstream traffic under the following conditions: Full load, one-third of the time; three-fourths load, one-third of the time; one-half load, one-third of the time. The Rhine is a swift stream without locks or dams and is closed to navigation about two months per year.

The Volga River is, in many respects, similar to the Ohio and Mississippi rivers, and there are transported on it annually about 10,500,000 tons of general merchandise and 3,900,000 tons of timber; 77 per cent of this total traffic is upstream and effected by a system of towing thought to be inferior to that at present in use on the Ohio River. Notwithstanding the fact that on account of ice in this stream there are only about six months of uninterrupted navigation in the year and that the navigation interests suffer an unusual amount of loss of navigation plant on account of such ice, the charge for the transportation of cereals is 2.2 mills per ton-mile; of manufactured iron, 1.8 mills; of steel, 1.6 mills, and of naphtha, 1.5 mills. In this navigation all towing is done against the current and the cost is materially greater than the cost of similar towing in slack water. Rates as low as one-half mill per ton-mile are sometimes obtained for upstream transportation of oil on this river, this being when the barges are loaded to 11 and 12 feet.[a]

As to the imports utilized in the manufactures along the Ohio River and its tributaries, many of these now enter New York on account of advantages that might be offset after the Isthmian Canal is completed and the Ohio River improved and New Orleans becomes a greater export and import city with improved coaling facilities. The existence of such a port in close proximity to the routes of vessels passing through the Isthmian Canal and the cheap inland transportation within the territory tributary to the Ohio and Mississippi system might offset to some extent the advantages that New York now holds on account of the immense passenger traffic between that city and Europe, which traffic in itself justifies many ships taking freight for ballast rather than go light. (See map No. 2.) It is impracticable to form an estimate of the amount of imports that could be expected via New Orleans. The steel manufacturing districts of the valley import manganese and magnesite, etc.; the glass industries import large quantities of clay used in making the pots in which are melted materials forming the glass.

If the present information as to the extent of iron ore in the Lake Superior district be only approximately correct, and if the ore available should fall under the control of a few corporations, it might not

[a] See report of Maj. F. A. Mahan, U. S. Army, retired, to the Chief of Engineers, dated February 16, 1904, forwarded by the Chief of Engineers to the Chairman Committee on Rivers and Harbors, United States House of Representatives, on February 29, 1904.

be many years before the question of importing iron ore from Cuba, South America, and other points is worthy of consideration. Should it become advisable to import such materials in large quantities, such importation would depend on water transportation to reach the furnaces in the interior, in the same manner that the use of Lake Superior ore in the Pittsburg district to-day and in certain Great Lakes cities is contingent on water transportation on the Great Lakes. The growth of Pittsburg and the Lakes cities has been to a great extent proportionate to the depths the Government of the United States has made in the channels connecting the Great Lakes.

The freight charge on sugar per ton in barge-load lots from New Orleans to Pittsburg in 1905-6 was approximately the same as the freight charge on iron ore per ton from the Superior district to Pittsburg. Farther down the Ohio River the freight charges would be less and a suitable coke supply at such places might give rise to extensive iron and steel industries utilizing foreign ores. Either iron ore or pig iron could be shipped from Alabama via the Tennessee and the improved Ohio rivers to points in the upper Ohio Valley in the case of a shortage in the Lake Superior ore supply. The rail haul would not be greater than the haul in the Lake Superior district at the head of the Lakes and the total freight cost of such movement to the Pittsburg district should not be greater than the freight cost on the iron ore now shipped from the Lake Superior district to Pittsburg.

The Congress of the United States at its last session granted a national charter for a canal connecting Lake Erie with the Ohio River at Beaver, between which points there is now an annual movement of more than 30,000,000 tons of freight, largely iron ore and coal. Should this canal be constructed the Ohio River from the mouth of the canal at Beaver would become a part of a line of water transportation connecting the Great Lakes system with the entire Ohio Valley, and thus add materially to the practicability of combining in manufacture the raw materials of these two great watersheds.

The State of Ohio has appropriated money toward the improvement of its canal system connecting the Great Lakes with the Ohio River via the Muskingum River, indicating a still further use of an improved Ohio.

Prospective local commerce.—There is a resident population in the counties along the banks of the Ohio River of more than 3,000,000. A list of cities and towns immediately on the river with their populations taken from the census of 1900 is given in Table 1, Appendix I.[a] There are 40 railway crossings or terminal points along the river. These railways could and would transport to the interior and distribute coal, timber, grain, southern products, and especially articles that can be most economically manufactured on the river on account of water transportation of the constituent materials. One of the first results that generally follow the improvement of a great waterway is a marked rail development for handling the consequent general business and for distributing finished products of manufacture. The most striking example of such a rail development is that between Lake Erie and western Pennsylvania, and from the latter to the interior, which development largely followed and was caused to a great extent by the improvements on the connecting waters of the Great Lakes.

[a] See page 40.

While the value of reliable water transportation on the Ohio will probably be measured more by the traffic to tide water than by local traffic, it is thought that the local commerce will be large. A line of transportation through an agricultural country following a parallel of latitude would not as a rule develop large local traffic, since the several communities traversed by this line of transportation would be engaged in the production of the same articles, all of which would seek a common market, and from which common market would be imported those necessities of life purchased in exchange for the commodities shipped out. And a line of transportation passing through cities engaged in manufacture of similar articles would for the reasons stated above not develop a large local business.

The Ohio and Mississippi system is peculiar in that the rivers composing this system flow southwest and south and consequently through territories producing all varieties of farm products—products that would be exchanged between the communities living along such streams, thus producing local commerce.

As referred to previously, the Ohio River in its descent from Pittsburg to Cairo meets the rock exposures of several thousand feet of the earth's crust. The presence of the minerals therein contained should give rise to a great variety of manufacture; one community manufacturing commodities that another could not manufacture, because the raw materials are not available and this condition should give rise to a large local commerce.

As stated previously, the Board is of the opinion that its orders do not contemplate a thorough investigation of the possibilities of manufacture along the Ohio River, and it must of necessity confine its report on prospective local commerce to the general principles underlying the development of such commerce and to mentioning a few of the commodities and manufactured articles already developed that would likely seek a local market.

Timber.—The area of marketable hard-wood timber in West Virginia, Kentucky, and Tennessee is very large and valuable, and nearly all of it is on streams tributary to the Ohio River.

Owing to the long rail haul of this timber to the populous manufacturing and mining districts of eastern Ohio and Pennsylvania, where the demands for it are very great, its price is necessarily high. The improved Ohio would enable much of this timber to reach the consumer at a considerable reduction in price and at the same time afford a better profit to the producer in the States named. The Pittsburg district for instance utilizes annually about 150,000 tons of pit posts in its mining operations. This timber so utilized is not marketable for other purposes and cheap transportation would open up an attractive market for timber not now used in portions of West Virginia and Kentucky. No estimate can be made of the profitable upstream movement of the higher grades of timber from the southern markets and from the lower Mississippi States. The demand for all classes of timber is, however, very strong and the upper Ohio Valley is thought to be one of the best markets in the country for all grades of timber.

Agriculture.—As is well known the agricultural resources of the Ohio Valley are very great. The present business done via the river in the transportation of farm products gives, however, but a scant

idea of what the traffic might be in case the river was improved so as to afford a reliable depth throughout the year. Western Pennsylvania for instance is a manufacturing and mining community and imports the greater portion of its foodstuffs. The staple products of the farm could on an improved river come in barge-load lots from Indiana, Illinois, Kentucky, and Ohio to this market. On an improved river, Ohio and West Virginia would furnish this market with its truck, garden, dairy, and poultry needs. Localities in different latitudes would exchange farm products with each other.

Cement.—A vein of ferriferous limestone from 2 to 16 feet thick is to be found covering a large area on both banks of the Ohio River in the vicinity of Portsmouth, Ohio, about 340 miles below the head of the river. Several companies have been chartered for and some are now engaged in the manufacture of Portland cement from this limestone. Cement is one of the products, like brick and building stone, on which transportation charges generally limit the radius of the area in which they can be profitably marketed.

Suitable stone for the manufacture of Portland cement exists in Indiana and Kentucky and the increasing use of concrete in the general building operations of the country would indicate large shipments locally of this necessary material. Two Portland cement factories have been established near Louisville, Ky., in the last two years.

Further investigations of the geological resources would no doubt indicate many other items that would probably enter into local commerce. Information in regard to the fluorspar industry is given in Appendix II, No. 17.[a]

FALLS OF THE OHIO AND THE LOUISVILLE AND PORTLAND CANAL.

In their original state the falls of the Ohio River constituted a complete obstruction to low-water navigation, which lead to the construction of a canal on the Kentucky side of the river, thus giving a low-water passage for commerce. This canal has been enlarged and otherwise improved from time to time and larger locks built and its present condition may be briefly described as follows: The total length of canal with the basin at the head and the excavated channel below is, approximately, 3 miles. The basin at the head is about 3,000 feet long and 800 feet wide at the upper end, narrowing to 500 feet at the lower. In this basin there is to be removed to complete the present approved project about 5,000 cubic yards of rock in ledge and about 29,000 cubic yards of disrupted rock. Below the basin the canal for 2,500 feet gradually narrows from 325 to 210 feet and in the next 300 feet of length rapidly narrows to 90 feet. The narrow part of the canal is 1 mile long, below which there is a basin 200 feet wide, while below the lock the channel excavated in rock is 200 feet wide. The present lock is a double-lift lock, each of the chambers having a width of 80 feet and an available length of 310 feet, the combined lift at low water being 26.5 feet. The gates and walls are of such height that the lock can not be operated at stages above 12.7 feet, upper canal gauge (415.704 above sea level), this being the stage at which upbound vessels can easily pass up over the falls. As a rule at the stage of 9 feet, upper canal gauge, it is necessary to use only the upper lift. The old 3-lift lock, built in 1825, is no longer used for

[a] See page 65.

lockages, but is occupied by an automatic gate or bear trap, and thus serves as a flushing chute for the canal.

The dimensions of the lock chambers are such that while 6 coal barges can be placed in the chamber only 2 coal boats can be passed at each lockage. This fact, together with the narrowness of the canal, which does not permit an upbound boat to pass a downbound tow, causes more delay to the coal fleets passing this point than at any other point on the river. As an instance of the delays caused by insufficient capacity of canal and locks the period from July 6 to July 17, 1902, is taken. On July 6 tows containing a total of 461 pieces, not including towboats, arrived at Louisville. These were passed through the locks as rapidly as possible, but the last boat was not passed through until July 17; 213 lockages were made during this time, 235 hours being consumed, of which 17 were devoted to other traffic. During the first eight days but one lift was used. From repeated observations made at different times when boats were promptly handled the capacity of the locks is about as follows: (1) Using one lift only, 56 coal boats or 156 coal barges per twenty-four hours; (2) using both lifts, 44 coal boats or 120 coal barges per twenty-four hours. This estimate assumes no delay in the canal itself due to passing of other traffic; in other words, that boats or barges are supplied as fast as they can be locked.

There are two principal channels or chutes over the falls—the Indiana and the Middle—the latter dividing at its lower end, the divisions being called the Kentucky Chute and Middle Chute. The most importanf of these channels is the Indiana Chute, and it is on this channel that all work of improvement has been done. Originally it was very crooked, with swift currents and whirls, filled with dangerous rocky points projecting from the sides and bottom. The work done to date has been in pursuance of a project to make this channel available for descending navigation drawing 6½ feet (coal barges) at the stage of 8 feet upper canal gauge and has consisted in the removal of rock ledges to deepen, widen, and straighten the channel and in the construction of the Wave Rock and Willow Point training dikes. The bulk of the work below the Louisville bridge, contemplated in the project, has already been done, whereas the larger part of that above the bridge is yet to be done. The project approved January 31, 1890 (see Report Chief of Engineers, 1890, pp. 2217 to 2221), recommended that the determination of the additional work required above the bridge be left to a later day; accordingly a Board of officers submitted on December 16, 1901, a recommendation for the additional works required to complete the project, this recommendation being approved December 30, 1901 (see Report Chief of Engineers for 1902, pp. 1970 to 1976). This constitutes the present approved project and provides briefly as follows:

(1) Submerged dam at Whirlpool Point	$7,500
(2) Raising movable dam north of canal wall	2,500
(3) Removing old dam and building movable dam	75,000
(4) Longitudinal contracting dikes	267,600
(5) Submerged dams below bridge	60,000
(6) Rock excavation	11,200
(7) Contingencies	42,380
Total	466,180

Sufficient funds to complete item 3 have been provided and the work is in progress, but none of the other items have been provided for.

The existing dams at the head of the falls do not completely close the river as there is no dam across the head of Indiana Chute. Beginning at the head of the canal the different sections of the dams are as follows: (1) Three sections of Boulé dam, total length with piers, etc., about 690 feet, crest at 411.004; (2) fixed concrete dam, about 1,850 feet long, crest at 411.004; (3) Middle Chute Boulé dam, 500 feet long, crest at 408.004; (4) fixed wooden dam, about 1,050 feet long, crest at 408.004; dam practically destroyed, but work is in progress to replace this dam by Boulé dam with crest at 412.004; (5) Boulé dam, 160 feet long, crest at 408.504; (6) wooden dam north of Indiana Chute, about 200 feet long, crest at 408.004; dam practically destroyed. On December 28, 1903, the Chief of Engineers forwarded with his approval a report by the local district engineer officer, upon a preliminary examination of the "Ohio River, at the head of the falls at Louisville, with a view to the enlargement of the present dam or the construction of a new one." (See Report Chief of Engineers, 1904, pp. 2702 to 2711.) As approved by the Chief of Engineers and the Board of Engineers for Rivers and Harbors, this project provided for the following work in addition to the work included in the project for improving Indiana Chute:.

500 feet Boulé dam across Middle Chute	$37,500
650 feet Chanoine dam across Indiana Chute	130,000
600 feet concrete dam north of Indiana Chute	15,000
Contingencies	36,500
Total	219,000

All of these sections of dams were to have a crest elevation of 8.0 feet upper canal gauge, reference 411.004. This report has not yet been acted upon by Congress.

The present condition of navigation past the obstructions known as the falls is, (1) at stages below about 7.5 feet, upper canal gauge, all traffic through canal; (2) over 7.5 feet, down-bound packets may use either canal or Indiana Chute; (3) over 9.5 feet down-bound tows of coal barges may use either canal or Indiana Chute; (4) 11.5 to 12.7 feet, down-bound tows of coal boats may use either canal or Indiana Chute; (5) below 12.7 feet all upbound traffic uses canal; (6) above 12.7 feet all traffic is by open river, navigation being then unrestricted. At stages below 11.5 feet the falls of the Ohio constitute the most serious obstruction on the river to the passage of coal fleets.

To increase the facilities for passing the falls the following work is deemed by the Board to constitute the most desirable plan: (1) to widen the narrow portion of the canal to 170 feet, thus permitting the passage of a down-bound tow of loaded coal boats and an upbound tow of empty coal boats, each tow 3 abreast; (2) to construct a new single lift concrete lock south of and by the side of the present lock; available dimensions of chamber to be 85 feet by 600 feet, thus permitting the passage at one lockage of 9 coal boats or 12 coal barges; (3) to create a pool above the falls with elevation of pool surface at 412.004 (9 feet on upper canal gauge), by the replacing of the wooden

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H. Doc. 492. 60 1

dam between Middle and Indiana chutes by a Boulé dam with crest at 412.004, which work is already provided for and under way, and by the construction of the sections of dam recommended by the district engineer officer in the project approved by the Chief of Engineers on December 28, 1903, with crests at 412.004 instead of 411.004, recommended therein, this height of crest being desirable for either a 6-foot or a 9-foot slack-water navigation or even if the river is not further improved by the slack-water method; (4) to remove the rock necessary to complete the widening of the basin at the head of the canal contemplated by the present approved project; (5) to reconstruct the three sections of Boulé dam just north of the head of canal with crest at 415.704, instead of crest at 412.504, as provided for in present project, thus eliminating the cross current across the head of the canal, which current now makes it very difficult for tows to enter the canal at stages between 8.0 and 12.7 feet. It is proposed to leave the crest of the present fixed concrete dam at 411.004 to serve as a fixed wier for the low-water discharge of the river. The Board is of the opinion further that this work will increase the capacity of the canal sufficiently to render unnecessary the further improvement of the Indiana Chute, and therefore recommends that all work under the present adopted project not included in the above project of this Board be omitted. The map herewith shows the falls of the Ohio and the Louisville and Portland Canal with the works proposed by the Board marked thereon in red. (See map No. 3.)

The carrying out of the work specified above will give a minimum navigable depth in the canal of 9 feet and will give the following conditions for navigation, (1) upbound traffic must use canal at all stages below 12.7 feet and the open river at all stages above; (2) down-bound packets must use canal at stages below 9.0 feet, between 9.0 and 12.7 feet, either canal or open river, above 12.7 feet the open river; tows of coal boats must use canal below 11.5 feet, between 11.5 and 12.7 feet, either canal or open river, above 12.7 feet, the open river. References are to stages which now give such readings on the upper canal gauge.

It is estimated that the cost of widening the canal to 170 feet, with necessary new drawbridges, purchase of land, etc., will be $673.000, and that the cost of the new lock, with operating machinery, guide walls, etc., will be $773,000. The cost of construction of the dams with elevations at 412.004 is estimated at $240,000. The item of reconstruction of the Boulé dam north of canal entrance is estimated at $31,000 and the completion of the rock removal in the basin at the head of canal at $43,000. The summary of these items is:

Widening canal to 170 feet, etc	$673,000
New lock and appurtenances	773,000
New dams	240,000
Reconstructing Boulé dam at head of canal	31,000
Removal of rock in basin	43,000
Total	1,760,000

The estimated cost of the items of the present approved project which are recommended by the Board to be omitted amounts to $391,180.

PROJECTS FOR OBTAINING DEPTHS OF 6 FEET AND 9 FEET BY LOCKS AND DAMS.

Appropriations have already been made toward securing a channel depth of 6 feet by locks and dams between Pittsburg and Cincinnati and much work has already been done in that direction. The following table shows what has already been accomplished and what remains to be done to provide a depth of 6 feet between Pittsburg and Cairo:

Dam No.	Distance from Pittsburg.	Elevation, upper pool surface.	Elevation, lower lock sill.	Elevation, sill of navigable pass.	Already appropriated.	Appropriation required to complete.	Location.
	Miles.						
1[a]	4.7	708.0	690.285	690.875	.....	.....	Davis Island.
2[a]	9.05	699.875	682.63	683.13	.....	.....	Merriman bar.
3[b]	10.86	692.184	674.89	675.89	.....	.....	Sewickley, Pa.
4[b]	18.56	684.393	667.25	667.75	.....	.....	Economy, Pa.
5[b]	23.9	676.752	659.26	661.26	.....	.....	Freedom, Pa.
6[a]	28.8	668.264	654.508	655.119	.....	.....	Beaver River.
7	36.9	661.1	645.7	647.7	$23,000	$1,094,800	Georgetown, W. Va.
8	46.08	653.7	637.3	640.3	460,000	711,525	Near East Liverpool, Ohio.
9	59.68	646.3	630.9	632.9	.....	1,200,000	Browns Island.
10	65.38	638.9	623.5	625.5	.....	1,200,000	Above Steubenville, Ohio.
11	76.3	631.5	615.1	618.1	460,000	658,093	Wellsburg, W. Va.
12	87.0	623.2	609.8	611.8	.....	1,280,000	2½ miles above Wheeling, W. Va.
13	95.76	617.8	601.0	602.8	712,000	862,964	Bellaire, Ohio.
14	115.0	608.0	591.2	593.2	.....	1,100,000	Near Fish Creek Island.
15	138.0	599.2	580.4	583.8	.....	1,100,000	Sisterville, W. Va.
16	164.3	588.4	570.4	573.0	.....	1,240,000	Above Carpenters bar.
17	179.3	578.4	561.2	563.4	655,000	151,814	8 miles below Muskingum River.
18	191.4	569.4	553.0	556.0	25,000	825,000	Below Little Hocking River.
19	205.0	561.0	542.0	545.6	.....	1,280,000	6 miles below Big Hocking River.
20	219.8	550.0	532.6	536.2	.....	1,200,000	Ravenswood, W. Va.
21	229.6	540.6	524.4	528.0	.....	1,100,000	Millwood, W. Va.
22	242.5	532.4	516.0	519.0	.....	1,100,000	7 miles below Letarts Falls.
23	266.4	524.15	505.4	509.4	135,000	965,000	1½ miles below Kanawha River (now No. 18).
24	287.7	513.4	496.3	500.0	.....	1,200,000	Below Little Guyandot.
25	309.0	504.3	487.5	490.8	.....	1,240,000	4 miles below Guyandot, Huntington, W. Va.
26	320.1	496.5	479.5	483.3	.....	1,240,000	4 miles below Big Sandy River.
27	339.0	487.5	472.0	475.7	.....	1,280,000	Jeanette shoals.
28	358.6	480.0	464.5	468.2	.....	1,360,000	3 miles below Scioto River, Portsmouth, Ohio.
29	391.4	472.5	454.0	457.1	.....	1,280,000	Wrightsville, Ohio.
30	431.0	462.0	444.0	446.6	.....	1,440,000	Wellsburg, Ky.
31	458.3	452.0	433.0	436.6	.....	1,280,000	9½ miles above Cincinnati, Ohio.
32	481.3	441.0	422.3	427.3	550,000	500,000	13 miles below Cincinnati (now No. 37).
33	510.0	430.3	413.0	415.0	.....	1,200,000	Gunpowder bar.
34	540.0	421.4	404.0	408.0	.....	1,400,000	3 miles above Carrollton, Ky.
35	604.0	412.0	374.056	403.0	75,000	1,760,000	Louisville and Portland Canal, Louisville, Ky.
36	630.2	380.0	361.0	364.6	.....	1,450,000	3 miles below Salt River.
37	676.3	369.0	349.6	353.6	.....	1,475,000	Alton, Ind.
38	740.5	357.6	340.0	342.2	.....	1,710,000	2 miles above Rockport, Ind.
39	768.5	348.0	329.6	332.6	.....	1,980,000	4½ miles above Newburg, Ind.; 11 miles above Green River.
40	804.3	337.0	318.0	321.6	.....	1,840,000	25 miles below Green River; 6 miles below Henderson, Ky.
41	844.3	326.0	307.4	310.6	.....	1,880,000	4 miles below Wabash River.
42	874.5	315.4	298.0	300.0	.....	2,180,000	11 miles below Tradewater River.
43	900.8	306.0	288.0	290.6	.....	1,348,000	Bay City, Ill.
44	937.3	296.0	277.0	280.6	.....	2,780,000	Little Chain, 13 miles below Tennessee River.
45	962.0	285.0	267.0	269.6	.....	2,260,000	Mound City, Ill.
Telephone line					.....	310,000	
Total						50,962,266	

[a] Completed.

[b] Will be completed in 1907.

The following table gives data, similar to that given above, for a channel depth of 9 feet between Pittsburg and Cairo:

Dam No.	Distance from Pittsburg.	Elevation, upper pool surface.	Elevation, lower lock sill.	Elevation, sill of navigable pass.	Already appropriated.	Appropriation required to complete.	Location.
	Miles.						
1[a]	4.7	703.0	690.285	690.875	.....	.....	Davis Island.
2[a]	9.05	699.875	682.63	683.13	.....	.....	Merriman bar.
3[b]	10.86	692.134	674.89	675.39	.....	.....	Sewickley, Pa.
4[b]	18.56	684.393	667.25	667.75	.....	.....	Economy, Pa.
5[b]	23.9	676.752	659.26	661 26	.....	.....	Freedom, Pa.
6	28.8	668.264	652.5	655.119	.....	$70,000	Beaver River.
7	36.9	662.0	644.7	647.6	$23,000	1,094,800	Georgetown, W. Va.
8	46.08	655.7	637.3	640.3	460,000	746,595	Near East Liverpool, Ohio.
9	55.6	649.3	630.9	633.9	.....	1,100,000	New Cumberland, W. Va.
10	63.5	641.9	622.5	626.5	.....	1,240,000	Browns Island.
11	76.3	633.5	615.1	618.1	460,000	698,098	Wellsburg, W. Va.
12	87.0	626.2	606.8	610.8	.....	1,320,000	2¼ miles above Wheeling, W. Va.
13	95.76	617.8	601.0	602.8	712,000	398,000	Bellaire, Ohio.
14	114.0	610.9	591.2	594.5	.....	1,100,000	Near Fish Creek Island.
15	129.0	602.2	583.4	586.8	.....	1,200,000	New Martinsville, W. Va.
16	146.4	594.4	575.6	579.0	.....	1,200,000	Near Petticoat Ripple.
17	167.4	586.6	567.4	571.2	.....	1,240,000	Below Carpenters bar.
18	179.3	578.4	561.2	563.4	655,000	177,000	8 miles below Muskingum River.
19	191.4	572.5	553.5	557.1	25,000	825,000	Below Little Hocking River.
20	201.4	564.5	545.0	549.1	.....	1,280,000	Below Big Hocking River.
21	213.8	556.0	539.0	542.0	.....	1,200,000	Portland, Ohio.
22	220.0	550.0	532.6	536.0	.....	1,200,000	Ravenswood, W. Va.
23	229.6	543.6	524.5	528.4	.....	1,200.000	Millwood, W. Va.
24	241.5	535.5	517.5	520.6	.....	1,200,000	6 miles below Letarts Falls.
25	260.0	528.5	508.5	513.3	.....	1,150,000	4 miles above Point Pleasant, W. Va.
26	274.0	519.5	502.5	505.8	135,000	965,000	9 miles below Kanawha River.
27	288.5	513.5	496.1	498.3	.....	1,240,000	Below Little Guyandot River.
28	309.0	507.1	487.5	491.7	.....	1,240,000	4 miles below Guyandot River, Huntington, W. Va.
29	320.1	498.5	479.5	483.1	.....	1,240,000	4 miles below Big Sandy River.
30	339.0	490.5	472.0	475.7	.....	1,280,000	Jeanette shoals.
31	358.6	483.0	464.5	468.2	.....	1,320,000	3 miles below Scioto River, Portsmouth, Ohio.
32	383.4	475.5	457.0	460.8	.....	1,380,000	Rome, Ohio.
33	396.6	468.0	450.0	453.6	.....	1,240,000	Manchester, Ohio.
34	431.0	461.0	444.0	446.0	.....	1,440,000	Wellsburg, Ky.
35	449.8	455.0	438.0	440.0	.....	1,440,000	New Richmond, Ohio.
36	460.0	449.0	430.1	433.6	.....	1,440,000	8 miles above Cincinnati, Ohio.
37	481.3	441.1	422.3	427.3	550,000	500,000	13 miles below Cincinnati, Cullums Ripple.
38	503.3	433.3	415.0	417.9	.....	1,240,000	14 miles below Big Miami River.
39	528.0	426.0	407.0	410.6	.....	1,450,000	Florence, Ind.
40	552.8	418.0	401.0	403.6	.....	1,620,000	9 miles below Kentucky River, near Madison, Ind.
41	604.0	412.0	372.0	403.0	75,000	1,760,000	Louisville and Portland Canal, Louisville, Ky.
42	624.5	383.0	365.6	367.6	.....	1,360,000	3 miles above West Point, Ky.
43	652.5	376.6	359.2	361.2	.....	1,480,000	New Amsterdam, Ind.
44	660.3	370.2	352.8	354.8	.....	1,280,000	Leavenworth, Ind.
45	700.1	363.8	344.4	348.4	.....	1,580,000	Holts bar.
46	748.5	355.4	336.0	340.4	.....	1,720,000	4 miles above Owensboro, Ky.
47	772.0	347.0	327.0	331.6	.....	1,720,000	Newburg, Ind., 7 miles above Green River.
48	804.3	338.0	318.0	322.6	.....	1,840,000	25 miles below Green River, 6 miles below Henderson, Ky.
49	830.6	329.0	309.0	313.6	.....	1,640,000	8 miles below Mount Vernon, Ind.
50	859.15	320.0	301.0	304.6	.....	1,480,000	19 miles below Wabash River.
51	876.8	312.0	292.0	296.6	.....	1,584,000	14 miles below Tradewater River, near Shawneetown, Ill.
52	912.5	303.0	283.0	287.6	.....	2,248,000	8 miles below Cumberland River.
53	947.0	294.0	276.0	278.6	.....	2,800,000	Grand Chain, 23 miles below Tennessee River.
54	962.0	287.0	267.0	271.6	.....	2,260,000	Mound City, Ill.
Telephone line						310,000	
Total						63,781,488	

[a] Completed. [b] Will be completed in 1907.

An accurate estimate of the cost of a lock and dam can be made only from an accurate topographical survey of the proposed location, with borings to determine the character of the foundations. The surveys so far made on the Ohio permit therefore only a general estimate of the cost of the locks and dams shown in the above projects. Basing prices upon those obtained at the dams now under construction and the increased cost to the United States by the application of the eight-hour law to such work, the cost of a dam about 1,000 feet long, having a navigable pass, weir, and bear trap, and a lock 600 feet long and 110 feet wide of the same type as heretofore constructed, may be estimated in the following manner:

Survey and purchase of site	$30,000
Foundations and masonry of lock	465,000
Gates and operating machinery	60,000
Dam	555,000
Dredging entrances of lock and in pool above	50,000
Buildings (lock-keepers' dwellings, power house, storehouses, etc.)	40,000
Total	1,200,000

The above estimates are based upon locks of the same size for all of the dams, because it is believed that the 600-foot lock will meet the requirements of slack-water navigation at all points in the river. An exception has been made, however, as stated in another place in this report, of the lock at the Louisville and Portland Canal.

While it is possible to construct and have ready for use a lock and dam in three years—that is, one year for the survey and purchase of the site and two years for the construction of the lock and dam—actual experience at the dams constructed or under construction has shown that a period of five years must be allowed, divided as follows: One year for survey and purchase of site, two years for construction of the lock, and two years for construction of the dam, for necessary dredging, installation of gates and machinery, and construction of buildings.

The funds required from year to year and the number of dams required to be under construction at the same time in order to complete the system within a definite period may be readily estimated.

The order in which the dams are constructed is a matter for consideration. The object of the improvement—that is, to provide a constant depth from one end of the river to the other—will only be accomplished by the construction of the entire system; but since it is improbable that appropriations will be made for the simultaneous construction of all the locks and dams it is thought that the greatest immediate benefit will follow the remodeling and completion of the dam system at Louisville, Ky., thus adding about one hundred days to the 9-foot natural navigation from Portsmouth to Cairo; that next in importance is the construction of a lock and dam below the mouth of Green River and one below the mouth of the Kanawha, thus giving a needed outlet to a portion of the Kentucky and West Virginia coal fields, and that then the locks and dams be built serially downstream—commencing with Lock No. 7.

For the proper control of a series of movable dams there is required a telephone line connecting the dams with each other and with gauge observers at some distance above the head of the series and above the mouths of large tributaries, for the purpose of giving warning of the

approach and passage of floods. A telephone system of this nature is now in use on the Kanawha River and is indispensible. It is estimated that such a line connecting the dams in the above projects would cost $310,000.

It is estimated that the average cost of maintenance of a lock and dam will be $15,000 per year, this amount covering the salaries of the lock force and the cost of repairs and renewals.

COMPARATIVE BENEFITS—6-FOOT AND 9-FOOT DEPTHS.

If the difference in the ton-mile transportation cost on a 6 and on a 9 foot depth in the same canalized stream was known, and if the total ton-mile freight movement was also known, it would be an easy matter to determine, from an economical standpoint, which of the two depths should be made.

While it is impracticable to determine the expected commerce on a canalized Ohio River, it is practicable to determine approximately the ratio of transportation costs, assuming the depths in question.

There are two types of barges now in use on the Ohio River drawing about 6 and 8 feet, respectively. With the actual experience, utilizing such barges as a basis, and assuming that one company is required to transport annually to certain destinations a fixed amount of coal or similar freight, the following comparative calculations result:

6-FOOT DEPTH.

Towboats are assumed as leaving Pittsburg with a tow of 10 barges. This tow is doubled after passing the Bellaire bridge—96 miles below Pittsburg. The speed of a boat and tow from Pittsburg to Bellaire is taken at 4 miles per hour and from Bellaire to Louisville, a distance of 503 miles, at 3.53 miles per hour. Fifty minutes is allowed for passing each lock above Bellaire and one and one-half hours below Bellaire. Barges are 180 feet long and 26 feet wide, with an actual draft of 5½ feet and a cargo of 670 tons. Three hundred and thirty-five running days are assumed in a year, one week is allowed for loading and one week for unloading barges, empty barges to be returned to original points of departure. Under the above conditions it would require the following plant to transport annually 3,500,000 tons of coal or similar freight from Pittsburg to Louisville:

Pittsburg to Louisville.

Above Bellaire:	
2 steamers, at $60,000	$120,000
2 steamers, at $90,000	180,000
31 steel barges, moving, at $6,500	201,500
Below Bellaire:	
12 steamers, at $90,000	1,080,000
186 steel barges, moving, at $6,500	1,209,000
250 steel barges, in reserve, at $6,500	1,625,000
Cost of plant	4,415,500
5 per cent interest	220,775
12 per cent depreciation	529,860
Maintenance of 2 small steamers, at $30,100	60,200
Maintenance of 14 large steamers, at $52,000	728,000
Annual expense	1,538,835

Freight cost per ton of coal, Pittsburg to Louisville, 43.97 cents, per ton-mile rate, 0.073 cent.

Pittsburg to Cairo.

Above Bellaire:	
2 steamers, at $60,000	$120,000
2 steamers, at $90,000	180,000
31 steel barges, moving, at $6,500	201,500
Below Bellaire:	
20 steamers, at $90,000	1,800,000
306 steel barges, moving, at $6,500	1,989,000
250 steel barges, in reserve, at $6,500	1,625,000
Cost of plant	5,915,500
5 per cent interest	295,775
12 per cent depreciation	709,860
Maintenance of 2 small steamers, at $30,100	60,200
Maintenance of 22 large steamers, at $52,000	1,144,000
Annual expense	2,209,835

Freight cost per ton of coal delivered at Cairo, 63.14 cents; per ton-mile rate, 0.0653 cent.

Pittsburg to New Orleans.

Freight cost per ton of coal delivered at Cairo, 63.14 cents.

Necessary plant between Cairo and New Orleans:	
15 steamers, at $120,000	$1,800,000
274 steel barges, moving, at $6,500	1,781,000
110 steel barges, in reserve, at $6,500	715,000
Cost of plant	4,296,000
5 per cent interest	214,800
12 per cent depreciation	515,520
Maintenance of 15 steamers, at $62,000	930,000
Annual expense	1,660,320

Freight cost per ton of coal from Cairo to New Orleans, 47.44 cents.

Summary, Pittsburg to New Orleans.

Freight cost per ton of coal from Pittsburg to Cairo	$0.6314
From Cairo to New Orleans	.4744
From Pittsburg to New Orleans	1.1058

Per ton-mile rate from Pittsburg to New Orleans, 0.0547 cent.

9-FOOT DEPTH.

Pittsburg to Louisville.

Barges are assumed as 180 feet long and 26 feet wide, with an actual draft of 8½ feet and a cargo of 1,105 tons. Other assumptions are the same as for the 6-foot depth except cost of boats and barges.

Necessary plant:	
Above Bellaire—	
2 small steamers, at $65,000	$130,000
1 large steamer	100,000
18 steel barges, moving, at $7,000	126,000
Below Bellaire—	
8 large steamers, at $100,000	800,000
112 steel barges, moving, at $7,000	784,000
151 steel barges, in reserve, at $7,000	1,057,000
Cost of plant	2,997,000

5 per cent interest	$149,850
12 per cent depreciation	359,640
Maintenance of 2 small steamers, at $30,600	61,200
Maintenance of 9 large steamers, at $55,000	495,000
Annual expense	1,065,690

Freight cost per ton of coal delivered at Louisville, 30.45 cents. Ton-mile rate, 0.0508 cent.

Pittsburg to Cairo.

Necessary plant:	
Above Bellaire—	
2 small steamers, at $65,000	$130,000
1 large steamer	100,000
18 steel barges, moving, at $7,000	126,000
Below Bellaire—	
13 large steamers, at $100,000	1,300,000
186 steel barges, moving, at $7,000	1,302,000
151 steel barges, in reserve, at $7,000	1,057,000
Cost of plant	4,015,000
5 per cent interest	200,750
12 per cent depreciation	481,800
Maintenance of 2 small steamers, at $30,600	61,200
Maintenance of 14 large steamers, at $55,000	770,000
Annual expense	1,513,750

Freight cost per ton of coal, Pittsburg to Cairo, 43.25 cents. Ton-mile rate, 0.0447 cent.

Pittsburg to New Orleans.

Freight cost per ton of coal, Pittsburg to Cairo, 43.25 cents.

Necessary plant between Cairo and New Orleans:	
10 steamers, at $130,000	$1,300,000
166 steel barges, moving, at $7,000	1,162,000
67 steel barges, in reserve, at $7,000	469,000
Cost of plant	2,931,000
5 per cent interest	146,550
12 per cent depreciation	351,720
Maintenance of 10 steamers, at $65,000	650,000
Annual expense	1,148,270

Freight cost per ton of coal, Cairo to New Orleans, 32.81 cents.

Summary, Pittsburg to New Orleans.

	Cents.
Freight cost per ton of coal, Pittsburg to Cario	43.25
Cairo to New Orleans	32.81
Pittsburg to New Orleans	76.06

Ton-mile rate, Pittsburg to New Orleans, 0.0376 cent.

In the plant assumed for both depths only steel barges are considered. This increases materially the cost of the operating plant. The increasing price of timber and the unsuitableness of the present 1,000-ton barge for any upstream traffic seems to justify the change. Earnings on any upstream freight however are not considered.

The above calculations indicate that the cost of transportation on a 6-foot depth is to that on a 9-foot as is 3 to 2, approximately. The calculated freight costs even for the commodities assumed are thought

to be lower than such costs will be in practice, since a constant supply and demand will never exist.

The average transportation cost for all classes of freight, moved either upstream or downstream, can not be calculated from any data available, but will of course be larger than that indicated. It is, however, thought safe to conclude that the difference between freight cost per ton-mile on a 9-foot depth and a 6-foot depth will generally be greater than two-tenths of a mill.[a] The average difference under actual conditions may be double this amount or more.

Under the assumption that the canalized depth on the Ohio will fix the draft of boats carrying Ohio Valley freight to New Orleans and taking the prospective commerce at 13,000,000 tons, about that now existing, and considering one half of this local and the other half through freight, and applying a haul of 400 miles to the local and 1,500 miles to the through freight, the following minimum annual saving in freight costs, utilizing a 9-foot instead of a 6-foot depth, is indicated—$2,280,000. This saving will of course vary with the amount and character of freight transported. Considering that a commerce of 13,000,000 tons has been developed on the Ohio River in its present state and bearing in mind that there are only about seventy-nine days annually that boats of 8½-foot draft can leave Pittsburg, Pa., and only about ninety-seven days per year that such boats can pass Louisville, Ky., and that a material part of the freight transported will be high class freight, it is thought that the ultimate annual saving on a depth of 9 feet instead of 6 feet would be several times the amount stated above.

The estimated difference in first cost between the 6-foot and 9-foot projects is $12,688,034.

DREDGING.

Among the duties assigned by law to the Board is the following:

* * * They shall also examine the said river from the mouth of Green River to Cairo, with a view to determining whether an increased depth can be maintained by the use of dredges.

The Board assumes that by the words "increased depth" is meant 6 or 9 feet at ordinary low water, depending upon which depth project may be selected for the river above the mouth of Green River.

It has made a personal examination of this portion of the river by a daylight trip from Evansville to Cairo, and the survey made under

[a] *Summary of statements of cost of freight transportation on Ohio and Mississippi rivers, on the basis of a constant supply and demand (a minimum of 3,500,000 tons of coal or similar freight per annum is assumed).*

Towing in fleets of barges.	Miles.	Freight cost per ton.	Freight cost per ton per mile.
Pittsburg to Louisville, river improved to 6-foot depth	599	43.97	0.073
Pittsburg to Louisville, river improved to 9-foot depth	599	30.45	.0508
Pittsburg to Cairo, river improved to 6-foot depth	967	63.14	.0653
Pittsburg to Cairo, river improved to 9-foot depth	967	43.25	.0447
Pittsburg to New Orleans, Ohio River, improved to 6-foot depth	2,021	110.58	.0547
Pittsburg to New Orleans, Ohio River, improved to 9-foot depth	2,021	76.06	.0376

its direction has also covered this reach. While the time and funds at the command of the Board have not been as great as is desirable, sufficient data have been obtained upon which to base an approximate estimate of the first cost and cost of maintenance of a dredging plant such as it is thought may be adequate to maintain 6 or 9 feet depths, assuming that the physical characteristics of this part of the river are generally similar to those of the Mississippi River from St. Louis to Memphis and below and based upon the experience there gained in maintaining a 9-foot channel. This assumption however is somewhat arbitrary, from the fact that in the Ohio there are a good many hard gravel bars, with possibly rock substrata that may require blasting, so that before the final adoption of a dredging project this latter point would have to be definitely determined by borings, for making which the Board had no available funds.

Experience with gravel bars in the upper Ohio and to some extent on the lower river seems to indicate that when channels are once dredged they remain open for at least one season.

Were all the bars below Green River of gravel and susceptible of permanent improvement, it is doubtful whether it would be advisable to cut through them for fear of draining off the water in the succession of pools which these bars make and thus lowering the low-water slope, the low-water discharge from the canalized portion above being insufficient to maintain the present low-water line under such new conditions. This result might be obviated by building lateral spur dikes on the dredged bars, to equalize the low-water discharge sections; but this method is expensive in first cost and maintaining and locally uncertain in results, besides creating high velocities in the cuts, militating against the upstream traffic and making that downstream more hazardous. These dikes would also create obstructions that would be objectionable at half stages and below and might even to some extent affect higher stages.

For this reason and based upon the history of dredging operations, as shown in paper herewith,[a] marked "Appendix IV," the Board is of the opinion that no project for permanent improvement by dredging is practicable.

Whether annual hydraulic dredging through shifting bars as the river approaches its lower stages is practicable and worthy of consideration will now be discussed.

By this method the material is pumped out from along the desired channel and thrown to one side by water transportation through pipe lines, the deposited material tending to equalize the cross-sectional area, while creating no permanent obstruction, and most of the channels thus obtained being only available for the one season or part of the season of low water, it often being necessary to dredge more than once along the same cut.

What effect these cuts will have on lowering the low-water slope has not yet been determined on the Mississippi River by actual slope measurements, but as far as other observations can determine the effect is inappreciable.

From the Green River to Cairo is 190 miles, with an average fall in the low-water slope of 3.726 inches to the mile, slightly greater than the average fall from Evansville to Cairo, which is 3.49 inches to the mile.

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[a] See page 90.

In this distance there are fifty-seven 6-foot bars, and eighty 9-foot bars—that is, elevations of the river bed over which at low water there is less than 6 and 9 feet, respectively.

The total length of the 6-foot bars is 31 miles, with a vertical section of 309,750 square feet. For cuts through these bars to give 6 feet depth, having a bottom width of 250 feet, and 10 per cent added for side slopes and extra depth to allow for back settlement, will require the removal of 3,154,861 cubic yards of material.

The total length of the 9-foot bars is 61 miles, with a vertical section of 941,500 square feet. For cuts through these bars to give 9 feet depth, having a bottom width of 250 feet, and 15 per cent added for side slopes and extra depth to provide for back fill, will require the removal of 10,025,231 cubic yards of material.

The removal of the above 3,154,861 cubic yards for a 6-foot depth and of the 10,025,231 cubic yards for a 9-foot depth could be accomplished at 15 cents a cubic yard, making the cost of the 6-foot channel $473,229.15, and of the 9-foot channel, $1,503,784.65—not unreasonable sums considering the magnitude of the work and the resulting benefit to navigation, if there could be any assurance of permanency and of the preservation of pool levels without auxiliary works.

As already said, however, no such results can be expected, and the other dredging alternative must be considered, viz, annual removal of sufficient material to open up 6 or 9 foot channels over the many bars where permanent improvement is not practicable or desirable.

The data at hand do not enable the Board to determine how much of the above material will have to be removed annually, except in a most general way, but from what can be learned as to the composition and characteristics of the bars it will be unsafe to assume that less than the entire amounts above mentioned, respectively, will have to be removed annually, assuming that the water falls each year to the same low-water plane. This will not be the case as a fact, and there may be two or more years in succession when there will be higher low water and in which years the amount of material to be removed may be greatly reduced; but nevertheless it will be necessary to provide and keep ready for action a plant entirely adequate to deal with the lowest low water.

The questions then are—

1. What amount of hydraulic dredging plant will be needed to move annually 3,154,861 cubic yards of material, distributed over 31 miles of bars, for a 6-foot channel, and 10,025,231 cubic yards of material, distributed over 61 miles of bars, for a 9-foot channel?

2. What will be the first cost of these plants, respectively?

3. What will be the annual cost of their maintenance and operation?

Two papers setting forth briefly the experience as to hydraulic dredging for the removal of bars to improve low-water navigation on the Mississippi River, both above and below Cairo, with details of first cost, cost of repairs and renewals and of operation and results obtained, accompany this report, marked Appendix V and Appendix VI, respectively.[a]

The results of the Mississippi River work were obtained by working a dredging plant continuously throughout each twenty-four hours with 2 crews, until the bar had been cut through to full depth and width.

[a] See pages 104 and 106.

This is the most economical, and in fact the only practicable way to successfully attack these bars. Under recent decisions and interpretations, however, of the eight-hour law 3 crews for eight hours' work each will have to be subsisted and paid, increasing the cost of labor 50 per cent.

With this taken into consideration and from the data presented in these papers the following conclusions are reached:

For the 6-foot project.—1. That 8 well-equipped hydraulic dredging plants of the maximum capacity designed for use on the Mississippi River above Cairo will be required to maintain in the Ohio River from the Green to Cairo, a 6-foot boat navigation through the shifting bars.

2. That one such plant will cost $200,000, making $1,600,000 for the eight.

3. That the annual cost for the maintenance and operation of each plant will be $27,000, making $216,000 for the eight.

As the life of a plant can not be safely taken at more than twenty years, 5 per cent of first cost must be allowed for deterioration and $80,000 be added to the last figure, making the annual cost of maintaining a 6-foot channel $296,000, which represents a capitalization of $7,400,000 at 4 per cent per annum.

The 6-foot project therefore will require a primary expenditure of $1,600,000, with an annual outlay of $296,000.

For the 9-foot project.—1. That 20 well-equipped hydraulic dredging plants of the maximum capacity designed for use on the Mississippi River below Cairo will be required to maintain in the Ohio River from the Green to Cairo a 9-foot navigation.

2. That one such plant will cost $250,000, making $5,000,000 for the twenty.

3. That the annual cost for the maintenance and operation of each plant will be $30,000, making $600,000 for the twenty.

Adding 5 per cent of first cost for deterioration, viz, $250,000, and the annual cost of maintaining a 9-foot channel will be $850,000, which represents a capitalization of $21,250,000, at 4 per cent per annum.

The 9-foot project therefore will require a primary expenditure of $5,000,000, with an annual outlay of $600,000.

The serious objection to any dredging project for maintaining the desired depths is the lack of permanency and the immense plant needed to obtain quick results at critical times, all of which plant lies idle at great expense the greater part of the year and much of which may be idle for several years, due to the eccentricities of the low-water stages.

The first cost of the canalization of the Ohio River from the Green to Cairo for the 6-foot project is estimated at $12,268,000 and the annual outlay for operation and maintenance at $90,000.

The first cost of the canalization of the Ohio River from the Green to Cairo for the 9-foot project is estimated at $13,852,000 and the annual outlay for operation and maintenance at $105,000.

In conclusion, as to dredging, the Board is of the opinion that an increased depth up to 6 feet can be maintained by dredges from the mouth of Green River to Cairo, but that it is not economically practicable by dredges to maintain a 9-foot depth over this reach of river.

RECOMMENDATION.

The project above outlined for securing a depth of 6 feet by canalization provides for 32 locks and dams between Pittsburg and Cullums Ripple near Cincinnati, which is 5 less than the number proposed in the original project outlined in House Document No. 122, Fifty-fifth Congress, third session, and No. 336, Fifty-seventh Congress, first session. The project for 9 feet however requires 37 locks and dams, the same number as that called for in the original project. It is believed by the Board that the probable demands of traffic present or prospective can not be provided for by any other plan of improvement not having locks and dams or having a less number of locks and dams than those proposed by the Board.

In view of the enormous interests to be benefited by continuous navigation on the Ohio River and the great development which may be expected from such increased facilities the Board is of the opinion that the Ohio River should be improved by means of locks and movable dams to provide a depth of 9 feet from Pittsburg to Cairo.

The Board desires to express its high appreciation of the work done under its direction by Captain Burgess, the recorder.

All of which is respectfully submitted.

D. W. LOCKWOOD,
Colonel, Corps of Engineers.
E. H. RUFFNER,
Colonel, Corps of Engineers.
CLINTON B. SEARS,
Lieut. Col., Corps of Engineers.
GEO. A. ZINN,
Major, Corps of Engineers.
WM. L. SIBERT,
Major, Corps of Engineers.
H. BURGESS,
Captain, Corps of Engineers, Recorder.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

NOTE.—For report of the Board of Engineers for Rivers and Harbors see page 110.

APPENDIX I.

COMMERCIAL STATISTICS.

TABLE 1.

This table includes all cities and incorporated towns on the Ohio River with populations taken from the census of 1900. The columns showing freight movement are for 1905, the figures being furnished principally by the Ohio Valley Improvement Association, having been collected by the agents of that association from boat agents, principal manufacturers and shippers and other sources. The secretary of the association, Capt. J. F. Ellison, of Cincinnati, states: "In presenting the figures of the various towns and small landings along the river it is proper to say that, in the opinion of the writer, who has been connected for thirty years with the traffic of the Ohio River, some of the figures presented

show that they are exaggerated, while others are underestimated. It is further the belief of the undersigned that the figures as a whole can be considered as fairly accurate."

Where the columns for freight movement are not filled out the omission is due to the inability of the Board to obtain reliable statistics. The total freight movement obtained by taking the sum of the figures entered in the last column gives a fair idea of the total freight movement of the river, although a considerable amount appears in this table twice, being reported as sent at one place and received at another.

Place.	Population 1900.	Received upstream.	Sent upstream.	Received downstream.	Sent downstream.	Received and sent.
PENNSYLVANIA.		*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Pittsburg	321,616					
Allegheny	129,896	164,196			4,114,186	4,278,382
Elliott	3,345					
Bellevue	3,416					
Coraopolis	2,555					
Baden	427					
Freedom	1,783					
Rochester	4,688	1,900	400	16,740	1,000	20,040
Beaver	2,348					
OHIO.						
East Liverpool	16,485	30,000	2,000	19,000	11,400	62,400
Wellsville	6,146					
Empire	611				1,250	1,250
Toronto	3,526					
Steubenville	14,349	11,000	1,000	1,250	11,500	24,750
Mingo Junction	2,954					
Brilliant	646					
Martins Ferry	[a] 7,760					
Bridgeport	[a] 8,963					
West Wheeling	[a] 444					
Bellaire	[a] 9,912					
Powhatan Point	578		200			200
Clarington	905	200	3,650	3,000	300	7,150
Hannibal	610	300	700	1,260	300	2,560
New Matamoras	817	2,500	2,000	5,000	1,000	10,500
Grandview		100	100	300	25	525
Newport		1,600	1,200	1,750	500	5,050
Marietta	13,348	4,000	5,000	4,000	6,000	19,000
Racine	327	2,200	100	200	25	2,525
Syracuse	1,622					
Minersville	800					
Pomeroy	4,639	1,000	2,204	500	147,923	151,627
Middleport	604	650	100	450	4,600	5,800
Gallipolis	5,432					
Crown City	284					
Athalia	346	100	800	920	300	2,12
Proctorsville	523					
South Point	281					
Coal Grove	1,191					
Ironton	11,868	3,500	3,500	251,725	4,000	262,725
Hanging Rock	665	107	102	1,237	4,395	5,841
Sciotoville	1,300					
Portsmouth	17,870	7,500		8,500		16,000
Buena Vista		300	200	100	2,000	2,600
Manchester	2,008	10,015	6,000	28,300	9,100	53,415
Aberdeen	711					
Ripley	2,248			47,100		47,100
Neville	265	50	300	400	650	1,400
Moscow	475					
New Richmond	1,916					
Cincinnati	325,902	100,000	500,000	2,900,000	500,000	4,000,000
North Bend	582					
WEST VIRGINIA.						
New Cumberland	2,198	550	500	750	200	2,000
Lazearville	408					
Wellsburg	2,588	300	150	150	700	1,300
Wheeling	38,878					241,500
Benwood	4,511					
McMechens	1,465					
Moundsville	5,362	2,500	2,500	2,000	4,440	11,440
Powhatan	439					
New Martinsville	1,089	1,500	1,400	1,600	2,500	7,000
Sisterville	2,979	900	1,250	1,400	300	3,850
Friendly	253	50	200	25	20	295

[a] Included with Wheeling, W. Va.

Place.	Population 1900.	Received up-stream.	Sent up-stream.	Received down-stream.	Sent down-stream.	Received and sent.
WEST VIRGINIA—continued.		*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
St. Marys	825	800	3,500	1,700	1,850	7,850
Henderson	304					
Parkersburg	11,703	3,000	1,000	1,000	1,000	6,000
Ravenswood	1,074	4,800	200	300	200	5,500
Ripley	579					
New Haven	580	15	20	10	10	55
Hartford	515	600	1,800	300	3,000	5,700
Mason	904	10	10	30	450	500
Clifton	427	150	150	50	20	370
West Columbia	205	2	1	1	2	6
Spilman					6,235	6,235
Point Pleasant	1,984	450	450	400	650	1,950
Guyandot	1,450					
Huntington	11,923	5,000	3,250	4,000	3,250	15,500
Ceredo	1,279	300	250	700	250	1,500
Kenova	863					
KENTUCKY.						
Catlettsburg	3,081					
Ashland	6,800	33,500	8,000	126,200	8,200	175,900
Russell	743					
Greenup	711	1,000	1,000	750	2,500	5,250
Quincy	364					
Vanceburg	1,161	250	75	150	1,800	2,275
Concord	200					
Maysville	6,423	4,000	17,000	87,372	34,000	142,372
Dover	819					
Augusta	1,718					
Bradford	301					
Foster	148					
California	292	900		1,475	900	3,275
Newport	38,301	10				
Covington	42,938	10,125		160,000		170,125
Ludlow	3,334					
Warsaw	785					
Ghent	569	750	920	5,050	440	7,160
Carrollton	2,205	6,600	8,550	41,080	6,100	62,330
South Carrollton	452					
Milton	324	3,803	4,121	7,210	1,498	16,632
Louisville	204,731	74,830	58,102	818,590	66,004	1,017,526
West Point	489					
Brandenburg	218					
Peckenpaugh		75	500	50	50	675
Stephensport	241	250	1,500	1,500	150	3,400
Cloverport	1,656	1,450	200	675	175	2,500
Hawesville	1,041	350	200	350	400	1,300
Lewisport	328					
Patesville	258					
Owensboro	13,189	9,550	10,580	20,780	3,450	44,360
Henderson	10,272	75,155	7,000	108,500	10,000	200,655
Uniontown	1,532	9,115	1,000	3,160	250	13,525
Dekoven					38,106	38,106
Caseyville	217	800	625	750	450	2,625
Tolu		250	250	125	125	750
Weston		25	50	50	20	145
Birdsville		25	1,000	25	1,450	2,500
Carrsville	278	150	1,200	300	200	1,850
Bayou		150	900	200	1,200	2,450
Smithland	579					
Paducah	19,446	14,300	41,500	153,905	618,375	828,080
Ogden		500	700	800	400	2,400
INDIANA.						
Lawrenceburg	4,326	6,560	4,500	39,540	4,400	55,000
Aurora	3,645	20,180	10,000	39,222	5,800	75,202
Rising Sun	1,548	625	2,365	8,900	3,250	15,140
Patriot	408	600	1,650	1,200	1,650	5,100
Vevay	1,588	750	2,000	15,198	2,400	20,348
Brooksburg	149					
Madison	7,835	3,839	4,197	252,310	1,600	261,946
Hanover	377					
Jeffersonville	10,774	200	2,150	48,450	2,730	53,530
New Albany	20,629	1,255	958	125,960	1,177	129,350
Mauckport	290	500	200	250	5,200	6,150
Tobacco Landing		25	2,000	1,200		3,225
Amsterdam	200	980	11,520	7,520	1,025	21,045
Leavenworth	665	100	1,500	1,500	900	4,000
Schooner Point		50	400	400	100	950
Alton	239					
Derby		100	350	350	100	900
Rome		135	1,750	200	750	2,835

Place.	Popula. tion 1900.	Received up- stream.	Sent up- stream.	Received down- stream.	Sent dowu- stream.	Received and sent.
INDIANA—continued.		*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cannelton	2,188					
Tell City	2,680	8,221	1,516	20,115	1,162	31,014
Troy	599					
Grandview	822	1,500	5,000	600	10,000	17,100
Rockport	2,882	1,075	2,075	21,300	2,935	27,385
Newburg	1,371					
Evansville	59,007	65,500	15,000	288,940	5,120	374,560
Howell	1,421					
Mount Vernon	5,132	13,760	1,810	35,460	1,575	52,605
ILLINOIS.						
Shawneetown	1,698	9,180	175	63,926	3,410	76,691
Cave in Rock		500	1,350	1,900	6,650	10,400
Elizabethtown	668	575	1,200	1,950	9,725	13,450
Rosiclare	278	500	12,400	3,000	380	16,200
Golconda	1,140	456	600	500	200	1,756
Hamletsburg	280	30	10	50	20	110
Brookport		2,200	300	14,975	350	17,825
Metropolis	4,069	4,509	8,687	33,787	1,325	43,308
Olmstead	268					
Mound City	2,705	154,070	300	18,500	105	172,975
Cairo[a]	12,566	267,741	109,200	1,200	18,000	396,141
Total						13,955,918

[a] Includes freight at Cairo to and from the Mississippi River.

TABLE 2.

This table shows the commerce for the Ohio River for 1905, as compiled by the engineer officer in charge of the general improvement of the Ohio, from reports by owners, agents, and masters of vessels and transportation companies. (This table is published annually in the Report of the Chief of Engineers.) The total freight movement shown in this table gives an approximate statement of the tonnage for the Ohio, although a considerable quantity of the freight is unquestionably reported twice, and doubtless there is some not reported.

Commerce of Ohio River in 1905.

Name of boat or company.	Terminal points.	Distance.	In commission.	Freight.			Passengers.		
				Upstream.	Downstream.	Total.	Upstream.	Downstream.	Total.
		Miles.	*Months.*	*Tons.*	*Tons.*	*Tons.*			
The Monongahela River Consolidated Coal and Coke Co.	Pittsburg to Cairo	965.0	12.0	3,062	1,104,513	2,713,387			
Do	Pittsburg to Louisville	598.0			706,961				
Do	Pittsburg to Cincinnati	468.0			898,851				
C. Jutte & Co	Pittsburg to Cairo	965.0	12.0		336,000	336,000			
Sheridan-Kirk Contract Co	Pittsburg to Paducah	920.0	10.0	7,900	15,900	23,800			
West Kentucky Coal Co	do	920.0	6.0	50,000	150,000	200,000			
Steamer Frank Tyler	Pittsburg to Louisville	598.0	10.0	16,400	19,400	35,800		1,000	1,000
Pittsburg and Cincinnati Packet Line	Pittsburg to Cincinnati	468.0	7.0	24,179	26,573	50,752	14,456	16,918	31,374
Cincinnati, Pomeroy and Charleston Packet Co.	do	468.0	10.0	85,299	82,297	167,596	35,813	37,079	72,892
Clyde Coal Co	do	468.0	12.0		23,822	23,822			
Steamer Frank Gilmore	do	468.0	12.0		71,901	71,901			
Steamer Helen White	do	468.0	12.0		92,479	92,479			
E. E. Varian	do	468.0	10.0	4,270	21,200	25,470	1,500	1,500	3,000
Steamer W. C. Jutte	do	468.0	12.0		11,000	11,000			
Steamer Darling	Pittsburg to Point Pleasant	264.5	5.8	19,240	4,000	23,240			
Steamer Kanawha	do	264.5	10.0	8,825	6,400	15,225	5,400	4,900	10,300
Steamer Ben Hur	Pittsburg to Parkersburg	184.0	8.0	5,000	3,500	8,500	6,000	4,850	10,850
Steamer Egan	Pittsburg to Dam 18	179.0	9.0	1,000	5,000	6,000			
Steamer Lorena	Pittsburg to Marietta	171.0	8.0	4,000	4,500	8,500	7,500	8,500	16,000
Diamond Coal and Coke Co	Pittsburg to Bellaire	94.0	12.0		27,000	27,000			
Steamer The Leader	Pittsburg to Brilliant	74.0	12.0		403,750	403,750			
Steamer Pastime	Pittsburg to Toronto	59.0				5			35
John F. Klein	Pittsburg to Rochester	25.0	5.0						121,950
Sharpsburg Sand Co	Pittsburg to Freedom	24.0	12.0	43,500	92,000	135,500			
Steamer Francis J. Torrance	Pittsburg to Sewickley	11.5							3,000
Steamer Harmony	Pittsburg to Glenfield	9.0	12.0	69,872		69,872			
Steamer Short Cut	Pittsburg to Allegheny	1.0	12.0			55,000			78,550
Steamer Steel Queen	Allegheny to Bellevue	4.5	12.0	1,800	1,996	3,796	60,600	60,600	121,200
Steamer Crusoe	Wellsville to Congo	1.0	9.0			7,200			18,000
Toronto Ferry Co	Toronto to Zalia	1.0	9.0						18,177
Wm. Bay	Steubenville to Portsmouth	287.5	11.0	8,637	7,665	16,302	32,840	35,597	68,437
Steamer Buckeye	Steubenville to Sistersville	70.0	10.0	30,200	3,900	34,100			21,990
Steamer Pirate	Steubenville to Wheeling	22.5	5.0	120	13	133	225	226	451
Steamer Nathaniel	Steubenville to opposite shore	1.0	6.0						7,500
Steamer West End	Wellsburg to Brilliant	1.0	10.0			500			75,000
E. A. Thomas	Top-mill to Belmont	6.0	10.0	105,475		105,475			
Steamer Bessie Smith	Wheeling to Parkersburg	94.0	10.0			9,127			4,778
Steamer H. K. Bedford	do	94.0	9.7	3,380	4,290	7,670	7,508	10,108	17,616
Steamer Shifter	do	94.0				250			

W. J. Duffy	....do	94.0	5.0	35,000	280,000	315,000			
Steamer Beaver	....do	94.0	9.0	2,000	9,000	11,000	4,000	3,000	7,000
Steamer Jewel	Wheeling to Newport	66.0	9.0	7,000	3,000	10,000	6,000	6,519	12,519
Steamer Royal	Wheeling to Clarington	27.5	9.5	12,825	4,275	17,100	11,182	5,590	16,772
Steamer Catherine	Wheeling to Bellaire	4.0			80,675	80,675			
Steamer Charon	Bellaire to Benwood	1.0	12.0						264,582
Steamer Leroy	Sistersville to Marietta	34.0	10.0	4,880	600	5,480	9,817	11,480	21,297
Steamer Orion	Sistersville to Tewls Landing	1.0	10.5			18,000			14,600
Steamer Grace Virginia	New Matamoras to Hays Station	1.0	8.0			15,000			34,000
Steamer Melia A	New Matamoras to Matamoras	1.0	2.0			100			250
Steamer Valley Belle	Marietta to Middleport	80.0	10.0	10,422	6,179	16,601	2,875	3,547	6,422
Steamer Pioneer City	Marietta to Parkersburg	18.0	10.0	1,100	1,650	2,750	500	750	1,250
E. B. Sulter	Parkersburg to Louisville	414.0	7.0	4,910	29,710	34,620	570	740	1,310
Steamer Mountain State	Parkersburg to Carrollton	357.0	4.0	21,500	19,000	40,500			
Steamer Rayman	Parkersburg to Hockingport	14.5	10.0	500	100	600	2,000	1,950	3,950
Steamer Nina Paden	Parkersburg to Belpre	1.0	11.0			45,000			198,200
Steamer W. O. Hughart	Racine to Graham Station	1.0	9.0						8,550
B. J. Riggs	Syracuse to Addyston	288.0	9.0	400	43,105	43,505			
Steamer Klondike	Syracuse to Gallipolis	24.5	10.0	450	23,000	23,450	3,465	4,228	7,693
John Barrett & Son	Pomeroy to Cairo	715.5	10.0	19,300	34,150	53,450			
New Haven Towboat Co	Pomeroy to Henderson	545.0	6.0	86,960	78,040	160,000			
Thos. J. Hall	Pomeroy to New Albany	354.0	12.0	25,000	150,000	175,000			
Steamer Convoy	Pomeroy to Louisville	349.0		4,550	84,500	89,050			
The E. J. Hickey Transportation Co	....do	349.0	11.0		228,436	228,436			
Steamer Gondola	Pomeroy to Gallipolis	19.5	4.2	427	618	1,045	64	76	140
Steamer Champion No. 3	Pomeroy to Mason City	1.0							50,000
Steamer Little Ben	Middleport to Clifton	1.0	10.0						22,425
The Campbell's Creek Coal Co	Point Pleasant to Louisville	334.0	11.0		282,225	282,225			
Steamer Otto Marmet	....do	334.0	12.0	18,754	143,156	156,910			
The Collins and Hartweg Co	Point Pleasant to Madison	289.5	10.0		222,870	222,870			
Marmet Coal Co	Point Pleasant to Cincinnati	204.0	12.0		206,624	206,624			
Steamer Winifrede	....do	204.0	8.0		111,500	111,500			
Steamer Carrie Brown	Gallipolis to Huntington	39.0	12.0	3,260	6,260	9,520	9,475	14,521	28,996
Steamer Chevalier	....do	39.0	10.0			6,000			16,000
Steamer Francis	Gallipolis to Steinbergen Landing	1.0	12.0			6,000			21,479
Steamer Arion	Proctorville to Guyandot	1.0	11.0			36,000			78,600
C. Crane & Co	Guyandotte River to Cincinnati	164.0	8.0		440,000	440,000			
Steamer Sea Lion	Huntington to Louisville	290.0	10.0	9,200	77,560	86,760			
Steamer Leni Leoti	Huntington to Cincinnati	160.0	3.0	15,000	47,000	62,000			
Steamer Thealka	Huntington to Ashland	14.0	12.0	200	300	500			
Steamer City of Huntington	Huntington to Rockwood	1.0	12.0						58,400
Steamer Telephone	Catlettsburg to Rome	66.0		23,004	70,000	93,004	10,000	9,000	19,000
Steamer Bonne	Catlettsburg to South Point	1.0	8.0			200			3,500
Steamer Bob Ballard	Ashland to Ironton	5.0	11.0			499,080			
Steamer Wenona	Ashland to Coal Grove	1.0	12.0						213,694
Steamer Ironton	Ironton to Russell	1.0	12.0			59,093			120,670
Steamer Donca	Portsmouth to Rome	27.5	1.5	75	205	280	1,045	1,075	2,120
Steamer Dan Patch	....do	27.5	2.0	45	162	207	849	963	1,812
Steamer Emily	Portsmouth to Fullerton	2.0	12.0			3,650			49,640
Steamer Chesapeake	Portsmouth to South Portsmouth	1.0	12.0			19,037			171,567
Steamer W. H. Whiteman	Manchester to South Manchester	1.0	10.0			9,358			30,802
Steamer Proctor K. Smiley	Ripley to South Ripley	1.0	10.0			4,200			35,000

Commerce of Ohio River in 1905—Continued.

Name of boat or company.	Terminal points.	Distance.	In commission.	Freight.			Passengers.		
				Upstream.	Downstream.	Total.	Upstream.	Downstream.	Total.
		Miles.	*Months.*	*Tons.*	*Tons.*	*Tons.*			
Steamer Arlona May	Higginsport to opposite shore	1.0	7.0			65			2,100
Steamer Whisper	Augusta to Boudes	1.0	10.0						9,880
Steamer Silver Star	New Richmond to Aurora	46.0	11.0				200	200	400
Steamer New Richmond	New Richmond to South New Richmond	1.0	9.7			9,865			14,924
Coney Island Co	New Richmond to Cairo—excursions	516.0	1.0	192	80	272	33,579	19,171	52,750
Do	Coney Island to Cincinnati	9.0	3.3	808	202	1,010	293,124	286,487	579,611
Smith Sand Co	Dayton to Addyston	17.0	10.0		360,000	360,000			
Steamer Charlotte Boeckler	Cincinnati to Cairo	497.0	11.0	28,312		28,312			
Lee Line	do	497.0	6.7	4,857	11,814	16,671	4,076	4,030	8,106
Steamer Nellie Willett	do	497.0	10.0	21,700	18,600	40,300			
Steamer Martha H. Hennen	Cincinnati to Paducah	451.5	8.0	13,000		13,000			
Burnside and Burkesville Transportation Co.	Cincinnati to Smithland	439.5	6.0	590		590			
Steamer E. T. Slider	Cincinnati to Evansville	316.0	12.0	38,315	126,400	164,715			
Steamer Avalon	Cincinnati to Louisville	130.0	5.3	6,450	2,580	9,030	2,835	2,640	5,475
Steamer Blue Wing	do	130.0	11.0	9,725	29,000	38,725			
Louisville and Cincinnati Packet Co	do	130.0	10.6	66,595	79,525	146,120	73,322	56,960	130,282
Frank Miller	do	130.0	6.0		51,000	51,000			
Levi J. Workum	Cincinnati to Madison	85.0	10.0	28,830	20,006	48,836	2,057	2,000	4,057
Steamer Boone No. 5	Cincinnati to Constance	7.0	10.0			24,500			16,970
Steamer Pauline	Lawrenceburg to Aurora	4.0	9.5	459	5,149	5,608	7,028	7,028	14,056
Steamer Swan	Aurora to Patriot	21.0	9.0	570	405	975	4,055	3,100	7,155
Steamer Eva Everett	Vevay to Ghent	1.0	12.0			50,000			4,000
Steamer Hiawatha	Carrollton to Leavenworth	117.0	9.0						74,257
Louisville and Jeffersonville Ferry Co	do	117.0	8.0						165,470
Steamer Falls City	Carrollton to Louisville	57.0	9.0	18,000	21,600	39,600	3,296	3,150	6,446
Steamer Fannie	do	57.0		100	40	140			
Steamer White Dove	do	57.0	10.0	1,500	750	2,250	1,200	1,800	3,000
Steamer Raymond	Carrollton to Oldhams Landing	33.0	9.0	500	3,000	3,500			
Steamer Lucile	Carrollton to Bethlehem	29.0	8.0	1,434	1,874	3,308			
Steamer John Mackey	Carrollton to Madison	14.0	.3	1,400	600	2,000			
Steamer Trimble	Milton to Madison	1.0	12.0			25,550			22,900
Steamer Hanover	Madison to Bethlehem	14.5	10.0	850	700	1,550	2,500	2,000	4,500
Steamer William Duffy	Twelvemile Island to Louisville	12.0	9.0		154,320	154,320			
Louisville and Jeffersonville Ferry Co	Jeffersonville to Louisville	1.0	12.0						527,943
Steamer Alma	Louisville to Evansville	185.0	10.0	5,740	10,770	16,510			
Steamer Little Willie	do	185.0	10.0	2,382	13,000	15,382			
Louisville and Evansville Packet Co	do	185.0	10.0			146,010			15,146
Steamer Willie	Louisville to Leavenworth	60.0	6.0	500	100	600			
Steamer Little Archie	Brandenburg to Stephensport	55.0	7.0	160	240	400	50	110	160
Steamer Brownie	Chenaults to Tell City	31.0	5.0	36	245	281	2,250	1,800	4,050

Steamer Fawn	Cloverport to Henderson	89.0	5.0	5,045	1,444	6,489			
Steamer Nellie	Cannelton to Evansville	66.0		30		30			
Steamer Gazelle	Cannelton to Owensboro	32.0	10.0	1,200	4,800	6,000	6,200	6,200	12,400
Steamer Major	Cannelton to Hawesville	1.0	11.0			1,980			3,600
Steamer Eclipse	Tell City to Evansville	63.0	10.0	1,500	4,000	5,500			
Steamer Ondine	Rockport to Brookport	183.0	8.0	200	800	1,000			
Steamer Wabash	Owensboro to Paducah	171.0	8.0	18,485	1,750	20,235			
Robert Hornbrook	Owensboro to Shawneetown	99.0	8.0	161,616	42,824	204,440	5,082	5,082	10,164
John Archibald Coal Co	Owensboro to Mount Vernon	70.5	7.0	1,400	35,000	36,400			
Steamer Little Clyde	Mouth Green River to Joppa	161.0	10.0		260,300	260,300			
Steamer Neptune	Mouth Green River to mouth Cumberland River.	133.0	10.0	1,100	35,000	36,100	10	10	20
Steamer Alice L. Barr	Mouth of Green River to Evansville	8.0			50,936	50,936	61		61
Evansville and Bowling Green Packet Co	do	8.0	11.0	24,620	11,180	35,800	8,558	7,290	15,848
Steamer Edgar	do	8.0	8.5		30,000	30,000			
Steamer Francis	do	8.0	10.0		1,130,385	1,130,385			
Green River Mining, Manufacturing and Transportation Co.	do	8.0	9.0		37,500	37,500			
Steamer Kenois	do	8.0	1.0		750	750			
Steamer Old Reliable	do	8.0				22,500			
Charles McNutt	do	8.0	9.0			34,100			
P. H. Johnston	do	8.0	10.0	500	1,875	2,375	204	200	404
Steamer Sunbeam	do	8.0			48,072	48,072	3		3
Evansville, Paducah and Cairo Line	Evansville to Paducah	137.0	10.0	16,950	12,300	29,250	12,366	13,401	25,767
Steamer J. F. Buckham	do	137.0	7.0	12,000	16,000	28,000			
Ryman Line	Evansville to Smithland	125.0	5.5	3,200	4,500	7,700	764	892	1,656
Steamer Alfred D. Owen	Evansville to Shawneetown	65.0	10.0		10,000	10,000			
Steamer Jewel	Evansville to Henderson	11.0	10.0	5,000	20,000	25,000	21,750	25,470	47,220
Steamer Harth	Henderson to Paducah	125.5	10.0		18,000	18,000			
Steamer Henderson	Henderson to Indiana shore	1.0	7.0			650			5,659
Steamer New Haven	Mount Vernon to Shawneetown	28.5	12.0	2,500	2,500	5,000			
Ayer & Lord Tie Co	Mouth Wabash River to Brookport	85.0	9.0		305,811	305,811			
John S. Summers	Shawneetown to Cairo	117.0	10.0	130	44,208	44,338			
Steamer Enos Taylor	Shawneetown to Metropolis	81.0	8.0	5,005	13,326	18,331			
Fairview Mining Co	Shawneetown to Brookport	75.0	12.0	5,000	17,790	22,790	99	102	201
Steamer Georgia	Shawneetown to Blackburn	1.0	12.0			500			7,300
Steamer Nellie Brown	Dekoven to Paducah	61.0	12.0		38,106	38,106			
Steamer Charles Turner	Mouth Tradewater River to Joppa	76.0			410,800	410,800			
Steamer Royal	Golconda to Paducah	30.0	9.0	2,115	1,410	3,525	5,878	7,398	13,276
Aberdeen Coal and Mining Co	Mouth Cumberland River to Joppa	28.0	10.0		26,542	26,542			
Steamer Dick Fowler	Paducah to Cairo	45.0	11.0	7,350	8,200	15,550	25,000	26,585	51,585
St. Louis and Tennessee River Packet Co	do	45.0	12.0	19,055	42,025	61,080	6,229	6,171	12,400
Steamer Oscar F. Keeler	do	45.0	5.0	150,000	50,000	200,000			
Steamer Lyda	Paducah to Joppa	16.0	9.0		62,000	62,000			
Steamer George Cowling	Paducah to Metropolis	9.0	12.0			6,427			45,426
Illinois Central Railroad Co	Paducah to Brookport	3.0	12.0			27,447			23,064
Steamer Bettie Owen	do	3.0	12.0	15,650	7,800	23,450	12,500	12,500	25,000
Steamer Fred Bennett	Mound City to Cairo	6.0	8.0	40,940		40,940			
Total				1,547,517	10,473,745	13,163,656	767,960	746,494	4,198,971

TABLE 3.

This table shows the movement of freight at the mouth of each of the most important tributaries of the Ohio for the calendar year 1905. For those streams having a lock near the mouth the figures give the tons of freight passing the lock; in other cases the figures are supplied by the district engineer officers from statistics collected from boats plying on the streams. Instead of giving statistics for the Allegheny and Monongahela rivers, the figures for the Davis Island Dam are given, as there is an immense local traffic to Pittsburg from those rivers which does not go below that city.

For the Little Kanawha the tonnage at Lock No. 5 is given, as no statistics for Lock No. 1 could be obtained.

	Tons.
Davis Island Dam	4,278,382
Muskingum	38,070
Little Kanawha	106,520
Kanawha	1,522,874
Big Sandy	146,613
Green	425,120
Wabash (estimated)	40,000
Cumberland	253,430
Tennessee	663,606
Total	7,474,615

TABLE 4.

This table shows the traffic by way of the Davis Island Dam for the year 1905.

[Compiled from reports of the district engineer officer in charge.]

Article.	Ascending.	Descending.	Both ways.
	Tons.	*Tons.*	*Tons.*
Coal		3,926,319	3,926,319
Iron and steel manufactures	165	130,119	130,284
Lumber	11,535	3,937	15,472
Sand	105,400	4,620	110,020
Miscellaneous	47,096	49,191	96,287
Total	164,196	4,114,186	4,278,382

TABLE 5.

This table shows the traffic through the Louisville and Portland Canal and through Indiana Chute, Ohio Falls, Louisville, Ky., for the calendar year 1905.

[Compiled from reports of the district engineer officer in charge.]

Article.	Through canal.	Over falls.	Both waterways.
	Tons.	*Tons.*	*Tons.*
Cement	566	199	765
Coal	942,444	650,043	1,592,487
Cotton	611	32	643
Flour	284	38	322
Grain	7,395	328	7,723
Hay and straw	7,734	1,310	9,044
Live stock	3,396	656	4,052
Lumber	41,517	7,596	49,113
Manufactured iron and steel	36,498	8,873	45,371
Miscellaneous	61,911	14,993	76,904
Molasses	3,357	25	3,382
Oil	704	165	869
Produce	3,052	91	3,143
Salt	16,780	205	16,985
Staves	12,786	13	12,799
Sugar	368	144	512
Tobacco	3,308	250	3,558
Whisky	1,323	168	1,491
Total	1,144,034	685,129	1,829,163

TABLE 6.

This table shows the total number of vessels with net tonnage documented at the different ports of entry on the Ohio River, as reported by the local surveyors of the port. (Does not include barges, scows, and the like, in which is transported the great bulk of freight.)

District.	Number.	Net Tonnage.
Pittsburg	174	35,556
Wheeling	140	10,491
Cincinnati	107	12,889
Louisville	78	6,044
Evansville	139	6,285
Paducah	44	4,103
Cairo	22	2,264
Total	704	77,632

TABLE 7.

This table gives the list of passengers reported by the supervising inspectors of the Steamboat Inspection Service of Cincinnati and Louisville for each of the local districts under their supervision:

Pittsburg district	432,700
Wheeling district	621,809
Gallipolis district	1,283,885
Cincinnati district	1,136,731
Louisville district	822,419
Evansville district	308,335

NOTE.—The report from Evansville includes passengers for the vicinity of Cairo, but not for the vicinity of Paducah, which are reported with the Cumberland and Tennessee rivers by the Nashville, Tenn., district.

TABLE 8.—*Descriptive table of industries, commerce, etc., of the four leading cities of the Ohio River.*

Wheeling, W. Va.—Wheeling with the adjacent towns of Benwood, W. Va., Martins Ferry, Bridgeport, and Bellaire, Ohio, has a population of about 125,000 and about 800 manufacturing establishments. Its principal industries are iron, steel, and tin, with an output of about $100,000,000 annually; pottery, with an annual output of about $1,250,000; glass; manufactured tobacco; tanneries; coal mines, etc. The steel industries obtain their ore from the Lake Superior region by rail, their coal from the mines in the immediate vicinity, their fuel gas from pipe lines. The potteries import large quantities of clay from Europe, which enter at the ports of New York, Philadelphia, and Baltimore, but which with uninterrupted navigation on the Ohio and Mississippi rivers would probably enter at the port of New Orleans. The timber and tobacco come to Wheeling from southern points, much of which could be brought by river. The tonnage of the 8 railroads entering Wheeling was about 5,250,000 tons for the year 1905, and the river tonnage for the same period was about 241,500, with 110,000 passengers.

Louisville, Ky.—Louisville, with the adjacent towns of New Albany and Jeffersonville, Ind., and other suburban towns on both sides of the river, has an estimated population of over 280,000. Its principal industries are the manufacture of agricultural implements, wagons, cast-iron pipe and structural and bar iron, enameled bath tubs, plumbers' supplies, stoves, boilers, machinery, tobacco, whisky, beer, flour, leather and leather goods, packing-house products, Portland and natural cement and lime, lumber, boxes, barrels, furniture, and many other manufactured articles, as well as the building of boats and barges. The great proportion of the raw materials used in these industries comes from Kentucky and the States near by. Pig iron comes principally from Alabama and Tennessee, with some from Pennsylvania and West Virginia; timber for lumber, wooden ware, furniture, etc., from Kentucky, West Virginia, Alabama, Mississippi, and Michigan, with mahogany logs from Central America, the latter received altogether by rail; tobacco comes principally from Kentucky and from Indiana,

Illinois, and Tennessee, and a small quantity from Virginia, West Virginia, and Ohio; grain for whisky from Kentucky and neighboring grain-producing States; cotton-seed oil for refining and for soaps, etc., comes from the cotton States; packing houses secure their cattle from Kentucky, Illinois and Indiana; flour is made from wheat grown in Kentucky, Illinois, and Indiana, a small quantity coming from west of the Mississippi River; lime and cement are made from local deposits of rock and clay, some of the cement rock being brought by barges from points a short distance down the river. The tonnage of the 9 railroads entering this place amounted in 1905 to 4,812,635 tons inbound and 3,395,747 tons outbound. (These figures do not include the entire movement for New Albany and Jeffersonville.) The river tonnage for the same year was 1,068,285 tons received and 131,121 tons shipped. These figures do not include freight passing through this point either by rail or river.

The following statement prepared by the Louisville Board of Trade shows the more important articles of freight, except coal, for the year 1905, for Louisville alone; similar figures for New Albany and Jeffersonville could not be obtained:

Article.	Received.	Sent.
	Tons.	*Tons.*
Wheat	159,729	39,398
Corn	365,729	287,722
Oats	84,248	60,599
Barley	13,322	45
Rye	24,545	15,749
Agricultural implements	6,006	30,023
Coffee	5,001	4,794
Sand and gravel	89,000	.....
Timber	118,521	.....
Cotton	2,043	136
Fertilizers	21,536	26,851
Flour	19,994	82,387
Furniture	4,297	23,790
Hides	10,630	3,030
Bacon	11,508	28,774
Hams	34	2,224
Lard	11,876	13,171
Iron and steel bars, etc	86,891	28,940
Pig iron	113,496	12,088
Leather	389	5,734
Machinery	4,727	7,183
Malt	7,029	4,217
Nails	10,581	9,488
Cotton-seed oil	79,498	78,192
Apples	9,501	6,192
Onions	4,145	9,915
Potatoes	14,875	22,518
Seeds, grass and clover	4,809	4,077
Soap	6,225	11,550
Stoves, stove castings	2,685	18,589
Sugar	30,091	25,725
Tobacco, leaf	100,908	75,062
Tobacco, manufactured	660	32,280
Vinegar and cider	6,274	31,148
Wagons	4,829	17,487
Whisky	32,800	93,577
White lead, paints, etc	6,456	13,071
Woolen goods	1,475	8,967
Wools	1,755	1,014
Total	1,467,729	1,135,752
Boots and shoes, cases	113,977	119,607
Dry goods, packages	626,363	876,941
Hardware, packages	235,882	1,230,611

The shipments of coal by river to Louisville, Jeffersonville, and New Albany amounted to 663,063 tons, and in addition 997,040 tons passed by Louisville for points below Louisville. No figures could be obtained for coal received and shipped by rail.

Cincinnati, Ohio.—Cincinnati, with the adjacent towns of Covington, Newport, and Latonia, Ky., and other suburban towns on both sides of the river, has an estimated population now of 550,000. Its principal industries are the manufacture of vehicles, structural iron, boilers, machinery, tools, flour, tobacco, whisky, beer, packing-house products, soap, leather and leather goods, shoes, regalia, clothing, lumber, cooperage, furniture, pottery, chemicals, electrical equipment, musical instruments, school books, etc. In all about 8,000 establishments, large and small, employing 120,000 hands, with a value of product for 1905 of $330,000,000. The fuel supply comes largely

from the valleys of the Kanawha and Monongahela rivers, being brought to Cincinnati by barge. The uncertainty of navigation on the Ohio River has made the supply of coal brought from those valleys by river sufficiently irregular to induce the carrying of coal in vast quantities by some of the railroads entering Cincinnati. Iron and steel come from the Pittsburg district and from the southern iron districts. Lumber is brought in chiefly by rail from eastern Kentucky, Tennessee, and the Mississippi Valley. Mahogany and other hard woods come from Cuba and Central and South America by rail at present, but with uninterrupted Ohio and Mississippi River navigation would probably come from New Orleans by water. Generally the sources of supply of raw materials are the same approximately as mentioned above for Louisville, Ky.

The following statement prepared by the Cincinnati Chamber of Commerce shows the more important articles of freight for the year 1905 for Cincinnati alone, similar figures for the adjacent towns could not be obtained:

	Received.	Sent.
	Tons.	*Tons.*
Ale, beer, and porter, barrels	64,154	667,890
Apples, green, barrels	299,891	145,948
Barley, bushels	1,171,779	188,928
Beef, pounds	1,194,178	1,589,623
Boots and shoes, cases	305,870	304,154
Bran, middlings, etc., tons	50,616	42,271
Broom corn, pounds	2,970,306	1,664,149
Butter, tubs, firkins, etc	154,605	68,297
Butterine, pounds	815,439	1,117,864
Cattle, head	307,776	127,468
Cheese, boxes	142,148	100,170
Coal, bushels	160,820,000	58,974,000
Coffee, bags	297,795	261,061
Coke, bushels	4,580,000	7,970,000
Corn, bushels	7,883,222	3,275,723
Cotton, bales	176,006	149,299
Eggs, cases, etc	420,604	311,396
Feathers, pounds	1,322,101	1,122,627
Flour, barrels	1,407,167	903,615
Fruit, dried, pounds	2,844,830	1,266,342
Grease, tierces	96,748	31,448
Hay, tons	131,220	78,341
Hemp, bales, etc	38,080	28,040
Hides, number	693,229	593,693
Hog product:		
Bacon, pounds	1,517,959	5,318,932
D. S. meats, loose, pounds	88,860,064	93,842,794
D. S. meats, in boxes, pounds	5,775,500	9,070,500
Hams, pounds	7,136,275	10,164,556
Lard, pounds	44,989,341	61,036,517
Pork, barrels	4,170	3,577
Hogs, head	1,063,144	403,742
Hops, bales	8,283	1,325
Horses, head	32,760	22,991
Iron and steel, tons	445,147	356,672
Iron and steel, scrap, tons	58,636	58,784
Iron, pig, pounds	588,297	383,975
Lead, pig, pounds	33,705,000	801,891
Lead, white, pounds		28,208,393
Leather, bundles	256,136	232,737
Lemons, boxes	70,156	31,108
Lumber, cars	68,804	54,876
Malt, bushels	1,402,614	670,200
Meats, fresh, pounds	23,434,960	27,310,966
Molasses, barrels	34,351	29,115
Oats, bushels	7,838,767	5,505,014
Oil, barrels	677,336	574,235
Oranges, boxes	398,531	212,387
Peanuts, bushels	85,550	85,917
Petroleum, barrels	261,032	95,516
Potatoes, bushels	1,548,426	629,370
Rice, barrels	50,220	29,232
Rye, bushels	595,758	180,662
Salt, barrels	472,233	353,893
Seed:		
Flax, bushels	4,378	1,288
Clover, bags	27,440	20,054
Timothy, bags	41,018	29,264
Other grass, bags	114,696	106,839
Sheep, head	509,925	362,737
Fruit, green, tons	23,733	14,236
Soap, boxes	233,078	3,067,590
Starch, boxes	572,522	453,724
Stearin, tierces	4,074	11,253
Sugar, barrels	290,253	127,354
Tallow, tierces and barrels	65,953	6,785
Tobacco, leaf, hogsheads	77,537	58,752

	Received.	Sent.
	Tons.	*Tons.*
Tobacco, leaf, cases and bales	64,031	28,522
Tobacco, manufactured, packages	160,187	248,736
Turpentine, barrels	46,790	37,984
Vegetables, green, tons	39,821	21,420
Wheat, bushels	2,844,191	2,284,085
Whisky, barrels	217,392	405,310
Wines and liquors, barrels	18,217	12,298
Wines and liquors, cases and packages	79,958	260,430
Wool, bales	120,053	120,842

Pittsburg, Pa.—The city of Pittsburg, together with the balance of the territory lying in the county of Allegheny, is known as the Pittsburg district and has a population conservatively and carefully estimated in the spring of 1906 at 952,541.

Its principal industries are the manufacturing of iron and steel ingots, billets, blooms, boilers, structural iron and steel, machinery, tools, and all the other various products of iron ore; glass of all description; food products; cork, and coke. In raw products Allegheny County produces vast quantities of bituminous coal, there being handled in the Pittsburg district upward of 45,000,000 tons of coal by rail and water during the year 1906.

There are also large wholesale jobbing and supply houses in the district, the principal businesses of which are machinery, mining, milling and oil well supplies, dry goods and clothing. According to the 1905 census report there were in Pittsburg and Allegheny alone over 1,500 manufacturing establishments, with a capital of over $260,500,000, and a valued output of over $211,000,000. A conservative estimate based on the reports of the banking institutions of the Pittsburg district placed the total wages paid annually in the Pittsburg district at $350,000,000.

Owing to the great conservatism and shortsightedness on the part of the industries of the Pittsburg district, an accurate and complete statement of the tonnage of the Pittsburg district can not be compiled. It is, however, conservatively estimated that 115,000,000 tons of freight will be handled by rail and water during the year 1906. Twelve million tons will be handled by water and 103,000,000 tons by rail.

Taking commodities individually a fair conception may be gotten as to the tonnage of the Pittsburg district. During the year 1905 pig iron production amounted to 5,410,890 tons and the total production of steel was 6,593,117 tons. The mill and furnace tonnage of one railroad for 1906 amounted to upward of 25,000,000 tons, divided into approximately 16,500,000 tons of raw material received and 8,500,000 tons of finished product forwarded.

In 1906 there were in what is known as the western Pennsylvania coke district 36,383 ovens in active operation. From these ovens there were shipped 18,171,941 tons of coke, valued at $36,424,451. The proportions of these figures to the total coke industries of the United States are 30.3 per cent ovens, 43.4 per cent products, and 44.1 per cent value, these values being at the ovens. In coal production there were handled in the Pittsburg district over 45,000,000 tons equal to 11.5 per cent of the total production of the United States. The iron and steel production of the Pittsburg district was equal to 39.3 per cent of the total production of the United States. The steel-rail production amounted in 1905 to 743,612 tons, or 22.1 per cent of the total production of the United States.

The pig-iron production amounted to 23.5 per cent of the total production of the United States. In structural shapes the Pittsburg district produced 53.1 per cent of the total production of the United States. (Prepared by J. A. Lord, chief of the bureau of statistics, Chamber of Commerce of Pittsburg, Pa.)

APPENDIX II.

NUMBER 1.

LETTERS OF THE PITTSBURGH AND CINCINNATI PACKET LINE.

PITTSBURGH AND CINCINNATI PACKET LINE,
Pittsburg, August 30, 1906.

DEAR SIR: Referring to our conversation in relation to freight formerly carried by this line for interior points that originated in Pittsburg territory and the Wheeling district.

Several years ago we were able by joint traffic arrangements with the railroads to make through rates from the above territories to Atlanta, Ga., Chattanooga, Tenn.,

Birmingham, Ala., Selma, Ala., Montgomery, Ala., and all southeastern points and also to Richmond, Va., Bristol, Va., Roanoke, Va., and all Texas common points, also Colorado and California points, but have since been debarred from giving our shippers the advantage of the former low rates which saved them from 10 to 40 per cent on the through all-rail rates, owing to the "community of interests of railroads" that withdrew all prorating arrangements from the water lines at almost all points between Pittsburg and New Orleans, compelling shippers in this district to ship to the above points by all rail instead of as formerly, using the water-and-rail route and make a saving as above stated. Shipments of most all Pittsburg commodities were carried in large volume for years by water and rail.

The singular feature of our business to-day is that the upstream shipments are heavier in volume than the downstream shipments. If the rail lines prorated with the water lines as they formerly did on the same basis they do with their rail connections, the shippers of this district would realize an enormous saving in freights by using the water and rail routes to almost any point in the west or south.

A great advantage to be gained by the shipping public as well as steamboat interests will be on the completion of the four locks and dams now under construction between Pittsburg and Beaver, which improvement will enable steamboats to reach Pittsburg 50 per cent oftener than they now do and which condition will largely benefit the river interests and those depending thereon as the certainty of prompt delivery into as well as prompt shipment out of Pittsburg, will greatly increase business both ways.

Not only is the public benefited by lower rates, but the time by river is much quicker for shipping than by rail and with the completion of locks and dams on the Ohio River a nearly uniform schedule can be maintained.

JAMES A. HENDERSON,
General Manager.

Maj. WM. L. SIBERT,
Corps of Engineers, U. S. Army, Pittsburg, Pa.

NUMBER 2.

PITTSBURGH AND CINCINNATI PACKET LINE,
Pittsburg, October 30, 1906.

DEAR SIR: Referring further to our conversation concerning river business from the Pittsburg territory.

Shipments have fallen off considerably in the past few years, due principally to the combination of interests that has been formed, and exercises a monopoly on many commodities manufactured in this vicinity. Owing to their peculiarly strong position they are able to force their customers to accept shipment by rail, even though they may want and so request their shipments by river in order to save time in transit and enjoy a saving of from 30 to 50 per cent in freight rates. Many cases have come to our notice where purchasers of commodities in the Pittsburg district who are located along the rivers have ordered goods and specifically requested shipment by river, but to no avail, as there appears to be a community of interest between capital and railroads working to their common advantage.

We have heard of instances where shipments have been made by river at the request of the buyer and he was charged up with the all-rail rate by the shipper, although the actual rate charged by the river on the shipment was 50 per cent lower than he was compelled to pay.

The buyer being prevented from enjoying the low river rates is naturally compelled to abide by the dictates of the seller, for should he too strenuously object to the arrangement, it is easy to force him into line by discriminating against him.

Very respectfully,

JAMES A. HENDERSON,
General Manager.

Maj. WM. L. SIBERT,
Corps of Engineers, U. S. Army, Pittsburg, Pa.

NUMBER 3.

LETTER OF JOHN H. JONES.

PITTSBURG-BUFFALO COMPANY,
Pittsburg, Pa., February 20, 1906.

DEAR SIR: In response to your letter of the 24th ultimo, I take pleasure in inclosing herewith a list of rail and water rates, which I trust will give you the information desired.

You will note that I have slightly changed the order of your queries, placing the rail rates together and the water rates to themselves, and made certain explanations as to some of the questions which might otherwise be somewhat misleading.

In giving the rail routes and rates I have given the distance via more than one road that you may use either the longer or shorter mileage. The rates are given per ton, unless otherwise specified, with the exception of the rail rates from New York to San Francisco and Chicago to San Francisco, which are of course per 100 pounds.

While you asked for only the Pittsburg, Pocahontas, and Kanawha coal districts, I have given the Thacker, New River, and Fairmont districts as well, in addition to the Hocking and No. 8 Ohio districts, which may be of use to you in making your comparisons. The distances from these coal districts are taken as nearly as possible from the center of the district to the point of destination; for instance, the Pocahontas district is figured from Elkhorn, the New River from Thurmond, etc.

I have been unable as yet to secure the vessel rates between Panama and San Francisco and from New Orleans to Colon, but send you the data in its present shape to avoid further delay in responding to your letter. My tardy response is due to the fact that some of the information had to be secured from numerous sources.

The tonnage from the Lakes is greater than that to the Lakes, but I have no means of ascertaining the proportion.

I shall be glad to furnish any additional information on the subject I can.

Yours, very truly,

JOHN H. JONES.

Mr. THOMAS P. ROBERTS,
Assistant Engineer, Engineer Office, U. S. Army, Pittsburg, Pa.

Statement of freight rates.

RAILROAD RATES.

[Furnished by John H. Jones.]

	Per ton.	Distance.	Cents per ton-mile.
COAL.			
Pittsburg district to New York:		*Miles.*	
Baltimore & Ohio R. R.	$2.15	529	0.406
Pennsylvania R. R.—			
Thirty-eighth street	2.05	444	.462
Harsimus	2.15	444	.484
Pittsburg district to Philadelphia:			
Baltimore and Ohio R. R.—			
Inside the Capes	1.80	438	.411
Outside the Capes	1.45	438	.331
Pennsylvania R. R.—			
Inside the Capes	1.80	359	.501
Outside the Capes	1.45	359	.404
Pittsburg district to Baltimore:			
Baltimore and Ohio R. R.—			
Inside the Capes	1.80	342	.526
Outside the Capes	1.38	342	.404
Pittsburg district to Buffalo: Pennsylvania R. R.	[a] 1.10	270	.407
	1.15	270	.426
Pittsburg district to Erie:			
Pennsylvania R. R.	(b)	147	
Bessemer and Lake Erie R. R.	(b)	160	
Pittsburg district to Ashtabula:			
Pennsylvania R. R.	(b)	124	.669
Pittsburg and Lake Erie R. R.	(b)	131	
Pittsburg district to Conneaut:			
Bessemer and Lake Erie R. R.	(b)	150	
Lake Shore and Michigan Southern Rwy.	(b)	136	
Pittsburg district to Lorain: Baltimore and Ohio R. R.	(b)	200	
Pittsburg district to Cleveland:			
Pennsylvania R. R.	(b)	140	
Baltimore and Ohio R. R.	(b)	170	
Erie R. R.	(b)	135	

[a] Not including delivery to vessel.

[b] Lake cargo coal, f. o. b. cars on dock, $0.83 per ton; lake fuel coal, f. o. b. cars on dock, $0.93 per ton; commercial coal, f. o. b. cars, $1 per ton.

Statement of freight rates—Continued.

RAILROAD RATES—Continued.

	Per ton.	Distance.	Cents per ton-mile.
COAL—continued.			
Pittsburg district to Toledo: [a]		*Miles.*	
Pennsylvania R. R.	[b] $1.25	261	
Wabash R. R.	[b] 1.25	250	
Pittsburg district to Chicago: [a]			
Pennsylvania R. R.	[b] 1.90	468	0.406
Baltimore and Ohio	[b] 1.90	478	
Pittsburg district to Cincinnati: [a]			
Pennsylvania R. R.	[b] 1.35	313	
Baltimore and Ohio R. R.	[b] 1.35	329	
Pittsburg district to Louisville: [a]			
Pennsylvania R. R.	[b] 1.90	423	
Baltimore and Ohio R. R.	[b] 1.90	459	
IRON ORE.			
Erie to Pittsburg [c]	[d] 1.18		.952
Ashtabula to Pittsburg [c]			
Conneaut to Pittsburg [c]			
Cleveland to Pittsburg [c]			
Lorain to Pittsburg [c]			
MISCELLANEOUS.			
Pittsburg to St. Louis	No through rates on coal; rates made up of local rates.		
Pittsburg to Denver			
Pittsburg to Memphis			
Pittsburg to New Orleans			
Pittsburg to San Francisco			
Chicago to San Francisco, Santa Fe		2,571	
Class A	[e] 1.60		
Class B	[e] 1.25		
Class C	[e] 1.00		
Class D	[e] 1.00		
Class E	[e] .95		.739
Commodity rates—			
Oxide of iron	[e] .60		
Creosote oil	[e] .50		Oil, .389
Chloride calcium	[e] .50		
Brick	[e] .50		
Rags	[e] .60		
Chicago to Buffalo:			
Flour and grain— [f]			
Lake Shore and Michigan Southern Rwy	[e] .11	550	.400
Wabash R. R.	[e] .11	525	.419
Buffalo to New York:			
Grain—			
Domestic—			
New York Central and Hudson River R. R.	[e] .10	429	.466
Erie R. R.	[e] .10	425	.471
Export	[e] .06½		
New York to San Francisco:			
Pennsylvania R. R.		3,423	.546
Atchison, Topeka and Santa Fe Rwy.			
Class A	[e] 1.60		
Class B	[e] 1.25		
Class C	[e] 1.00		
Class D	[e] 1.00		
Class E	[e] .95		
Commodity rates—			
Chloride calcium	[e] .75		.431
Clay	[e] .75		.431
Cast-iron pipe	[e] .70		.402
Brick	[e] .75		.431
Rags	[e] .60		.345

[a] Local rates to Pittsburg, 38 and 40 cents from the outside group in the 40-mile radius, with rates grading down to 25 cents for the shortest distance of about 10 miles. The Pan Handle rates are 35, 37, 39, and 40 cents.

[b] Net tons.

[c] Roads and mileage the same as given above for Pittsburg district to Erie, Ashtabula, Conneaut, Lorain, and Cleveland.

[d] Gross tons; rate is based on distance of 124 miles.

[e] Per hundredweight.

[f] Not for export.

Statement of freight rates—Continued.

RAILROAD RATES—Continued.

	Per ton.	Distance.	Cents per ton-mile.
MISCELLANEOUS—continued.			
Pocahontas coal mines to Norfolk:		*Miles.*	
Coal (Elkhorn to Norfolk), Norfolk and Western Rwy	$1.35	383	0.352
Chesapeake and Ohio Rwy. rates on coal:			
Kanawha mines to Cincinnati—			
Egg	1.00	236	.381
Run of mines	.95		
Slack	.90		
New River mines to Cincinnati—			
Egg	1.15	275	.345
Run of mines	1.00		
Slack	.95		
Kanawha mines to Lake Erie—			
Cleveland, Chesapeake and Ohio Rwy., and Big Four R. R	(a)	499	.185
Sandusky, Chesapeake and Ohio Rwy., and Big Four R. R	(a)	447	.206
Toledo, Chesapeake and Ohio Rwy., and Cincinnati, Hamilton, and Dayton Rwy	(a)	447	.206
NOTE.—From Fairmont (Baltimore and Ohio), Thacker (Norfolk and Western), and Kanawha (Chesapeake and Ohio) the agreed differential above Pittsburg on both cargo and fuel coal is 8½ cents, but last year the West Virginia roads generally published 92 cents on cargo, making the differential an even 9 cents, and the same differential on coal fuel, and it is presumed they will continue these rates, which would make the cargo rate from Thacker, Kanawha, and Fairmont 92 cents f. o. b. cars and lake fuel, $1.02 f. o. b. cars.			
The Southern Ohio rates from Hocking and No. 8 districts are:			
Lake cargo coal f. o. b. vessel	.85		.525
Lake fuel coal f. o. b. cars at dock	.90		
Commercial coal f. o. b. cars	1.00		
Hocking district (Nelsonville) to Toledo		185	
No. 8 district (Bridgeport) to Cleveland		162	
The local rate from Thacker and Kanawha to the ports where they load their cargo coal on Lake Erie is $1.25, and the local rate from Fairmont to Lorain, where their cargo is loaded principally, is $1.15. From Pocahontas last year's rates were on cargo coal $1.07 f. o. b. cars and on lake fuel $1.17 f. o. b. cars, with a local rate of $1.45 to Toledo and Sandusky, where they load. From New River the rates were exactly the same to Toledo, the port they use on cargo and lake fuel and local coal.			
Norfolk and Western Rwy.:			
Thacker district to Sandusky via Pennsylvania R. R		336	
Pocahontas district to Sandusky via Pennsylvania R. R		409	
Thacker district to Toledo via Hocking		350	
Pocahontas district to Toledo via Hocking		423	
Baltimore and Ohio R. R.:			
Fairmont district—			
Lorain	1.15	232	.496
Fairport		213	
Chesapeake and Ohio Rwy.:			
Kanawha district—			
Cleveland via Big Four		499	
Toledo via Cincinnati, Hamilton and Dayton		447	
New River district—			
Cleveland via Big Four		538	
Toledo via Cincinnati, Hamilton and Dayton		486	
Rail rates Pittsburg to San Francisco via New York or other port. [b]			
Lowest carload rates, Cincinnati to Lake Erie ports:			
Cleveland via Big Four	1.45	263	
Sandusky via Big Four		211	
Toledo via Cincinnati, Hamilton and Dayton	1.35	211	

[a] Cargo rate, f. o. b. cars, $0.92 per ton; lake fuel, f. o. b. cars, $1.02 per ton.
[b] No rates in effect. Rates on coal Pittsburg to New York, Philadelphia, and Baltimore given above (see p. 54).

Statement of freight rates—Continued.

WATER RATES.

	Per ton.	Distance.	Cents per ton-mile.
		Miles.	
Lake rates, Chicago to Buffalo, grain and grain products	[a] $0.09	[b] 825	
Lake rates, Lake Superior to Lake Erie ports, on iron ore:			
Buffalo to Duluth		985	
Erie to Duluth		917	
Cleveland to Duluth		834	
Buffalo to Marquette		749	
Erie to Marquette		681	
Cleveland to Marquette		598	
Buffalo to Escanaba		699	
Erie to Escanaba	.60	631	0.095
Cleveland to Escanaba		548	
NOTE.—The rates on ore from head of Lake Superior, including Ashland, Superior, Duluth, and Two Harbors, 75 cents; from Marquette, 70 cents; from Escanaba, 60 cents. This includes delivery to any Lake Erie port from Toledo to Buffalo, inclusive.			
Canal rates (Erie Canal), Buffalo to New York, on grain:			
Highest rate, 5 cents per bushel.	1.30	495	.263
Lowest rate, 3.8 cents per bushel.			
Average rate, 3.9 cents per bushel.			
Vessel rates:			
New York to Colon		1,980	
Class D [c]	20.00		
Class 1 [d]	10.00		
Class 2 [e]	8.00		.152
Class 3 [f]	6.00		
Class 4 [g]	5.00		
Minimum	3.00		
NOTE.—These rates are per ton of 40 cubic feet or 2,000 pounds.			
Panama to San Francisco [h]		3,423	
New Orleans to Colon [h]			
Norfolk to New York and Boston:			
Norfolk to New York	[i] .50	325	.154
Norfolk to Boston	[i] .70	532	.132

[a] Per hundredweight.
[b] Estimated.
[c] Acids, alcohol, chloroform, matches, phosphorus, etc.
[d] Chronometers, ebonite goods, furs, silk, and kid gloves.
[e] Allspice, apparel, arms, books, brass, cameras, etc.
[f] Bristles, canvas, carpets, champagne, china ware, etc.
[g] Castings, cement, chains, charcoal, coal (in bags), etc.
[h] Unable so far to get these rates.
[i] Per gross ton.

PANAMA RAILROAD RATES.

[Rates of freight per 100 pounds in cents United States gold.]

	Class 1. [a]	Class 2. [b]	Class 3. [c]	Class 4. [d]	Class 5. [e]
Colon to Panama (47¾ miles):					
For distance not exceeding 10 miles	30	25	21	17	13
Over 10 and not exceeding 20 miles	35	30	25	19	15
Over 20 and not exceeding 30 miles	40	35	28	21	17
Over 30 and not exceeding 40 miles	45	40	31	22	19
Over 40 and not exceeding 50 miles	50	44	34	23	20

Produce of the Isthmus at one-half above rates.

[a] Alcohol, ammonia, athletic goods, bath tubs, etc.
[b] Bells, belting, brick (loose), cotton (uncompressed bales).
[c] Cheese, coffee, edge tools, fruits, hardware, etc.
[d] Flour, hemp, jacks, junk, iron poles, etc.
[e] Bran, coal, fertilizers, guano (in bags), pig iron, and blooms.

NUMBER 4.

The Report of the Interstate Commerce Commission, 1904, gives the following average freight rates on railroads paralleling to some extent the Ohio and Mississippi rivers system.

Railroad.	Average revenue (freight) per ton mile.
	Cents.
Louisville and Nashville R. R. south of Ohio River	0.79
Illinois Central R. R., line south of Ohio River	.675
Mobile and Ohio R. R., line south of Cairo, Ill.	.682
Cincinnati, New Orleans and Texas Pacific R. R., within limits of Group V—Kentucky, Tennessee, Mississippi, Alabama, Georgia, and Florida	.752
Missouri, Kansas and Texas R. R.	
Line north of Dennison, Tex.	1.024
Line south of Dennison, Tex.	1.132
St. Louis, Iron Mountain and Southern R. R.	.786
International and Great Northern R. R., Texas and Louisiana	1.11
Galveston, Houston and Northern R. R.	1.278

NUMBER 5.

The Interstate Commerce Commission's Report on Statistics of Railways in the United States for the year 1904, gives for the total number of freight cars in use in the United States 1,692,194, which number includes box, flat, stock, coal, tank, refrigerator, and "other cars." To this number may be added 37,937 freight cars, mentioned separately in said report in "Fast-freight line service." Dividing the number of cars thus found into the total mileage of freight cars, which for 1904 was 14,353,650,056 miles, makes for the average daily movement of individual cars 22.7 miles.

NUMBER 6.

LETTER OF THE LEE LINE STEAMERS.

LEE LINE STEAMERS,
CINCINNATI, LOUISVILLE AND MEMPHIS DIVISION,
Cincinnati, Ohio, October 26, 1906.

MY DEAR MAJOR: In answer to your favor of the 24th instant, I herewith take pleasure in handing you class rates in effect at the present time between Cincinnati, Ohio, and Louisville, Ky., Evansville, Ind., and Cairo, Ill.

The next attached sheet will show both railroad and steamboat rates and the differential between the two routes.

The railroad rates shown between Cincinnati and New Orleans are those in operation at this time. The steamboat rate shown to that point is the rate that was in effect when there was a line of steamers operating between Cincinnati and New Orleans, but which you possibly know has not been in existence for the past six years.

Trusting that I have covered the points and given you the information desired, I am,

Very truly, yours,

J. F. ELLISON,
Superintendent and General Agent.

Maj. WM. L. SIBERT,
Corps of Engineers, Pittsburg, Pa.

Class rates from Cincinnati, Ohio, to points named.

[Furnished by the Lee Line steamers.]

	Class.					
	1.	2.	3.	4.	5.	6.
Louisville, Ky.:	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Railroads	25	22	17	12	9	8
Steamboats	17½	15	11½	9	7	7
Differential	7½	7	5½	3	2	1
Evansville, Ind.:						
Railroads	40	34	25	17	15	12
Steamboats	27½	22	17½	12	10	8
Differential	12½	12	7½	5	5	4
Cairo, Ill.:						
Railroads	44	37½	28½	19½	17	14
Steamboats	30	25	20	15	12	10
Differential	14	12½	8½	4½	5	4
Railroad rates in effect between Cincinnati and New Orleans, La	98	83	73	54	44	30
Old steamboat rate	60	50	40	30	25	20
Difference that did exist	38	33	33	24	19	19

All rates named above are in effect this October 26, 1906, except the steamer rates between Cincinnati and New Orleans, there being at this time no boats plying between the points named, neither is there at this time any water rates named from Cincinnati to New Orleans.

Respectfully, J. F. ELLISON, *Superintendent.*

NUMBER 7.

Rail rates to points on the Ohio River as compared with rates to cities equidistant not located upon the river.

The following shows the class rates of freight per 100 pounds from Cincinnati to the three points on the river indicated, and to three points not upon the river, representing approximately similar distances.

[Compiled by the Cincinnati Chamber of Commerce.]

		Miles.	Class.					
			1.	2.	3.	4.	5.	6.
			Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Cleveland, Ohio	Rail	263	37	32	23½	16	13½	10½
Parkersburg, W. Va	River	283	25	20	15	10	7½	6½
Erie Pa	Rail	350	42	36	27	18½	15½	13
Wheeling, W. Va	River	377	30	25	20	12½	11	9
Buffalo, N. Y	Rail	438	42	36	27	18½	15½	13
Pittsburg, Pa	River	487	30	25	20	12½	11	9

The river mileage here represented is 1,147 miles, and the aggregate of the single rates for each class is 298¾ cents. The rail mileage is 1,051 miles, and the aggregate of the single rates for each class is 436½ cents. In each comparison the river distance is somewhat in excess of the rail distance, and the total of the rail distance is 8.4 per cent less than the river, while the aggregate of the rail rates is 46 per cent in excess of the river rates.

Owing to the fact that the rail classification north of the Ohio River, which is understood to be in agreement with the river classification, is on a different basis from the classification governing rail freights in territory south of the Ohio River, comparisons are not so readily made southward as with the northern points, but it is understood that for the same kind of goods the rates prevailing south of Cincinnati are higher than for like goods and distances in territory north of Cincinnati.

C. B. MURRAY, *Superintendent.*

NUMBER 8.

LETTER OF PROF. HUGH A. HACKETT.

WESTERN UNIVERSITY OF PENNSYLVANIA,
Pittsburg, Pa., October 26, 1906.

SIR: Regarding the aggregate thickness of the rock formation between Pittsburg and Cincinnati, it is only possible to state it approximately for reasons stated below.

Prof. Edward Orton, LL. D., State geologist of Ohio, in the article "Ohio," ninth edition British Encyclopedia, volume 18, page 734, presents a geological map of Ohio and states the thickness of the principal formations, all of which have exposures along the Ohio River, as follows:

Formation.	Depth.	Distances along the Ohio River.[a]
	Feet.	
Carboniferous series	1,500	Pennsylvania State line to Greenupsburg—about 330 miles.
Subcarboniferous series	525	Greenupsburg to near Portsmouth—about 20 miles.
Devonian shale, etc. (not all of the Devonian rocks extend as far south as the Ohio River).	400	Portsmouth to about Buena Vista—about 15 miles.
Upper Silurian series	425	10 to 15 miles along the river, estimated.
Cincinnati group, or Lower Silurian series.	800	384 miles below Pittsburg to Cincinnati—82 miles; west of Cincinnati a number of miles more.
Total thickness	3,650	

[a] Added to Professor Orton's statement.

Professor Orton states that accepting the greatest known thickness of the individual series as above stated, the aggregate thickness of the rock exposure traversing the State, generally speaking, on north and south lines would be at least 5,000 feet.

Professor Orton wrote the above about the year 1890. In 1898 the Standard Oil Company drilled a well at Elizabeth, on the Monongahela River, 23 miles above Pittsburg, and reached a depth of 5,575 feet when the operating cable broke and drilling was not resumed. At the depth mentioned the drill had not quite pierced the Devonian rocks, so that to have reached the Lower Silurian, which is the surface exposure at Cincinnati, a depth of fully 6,000 feet would have been required. It is evident from this test well that the vertical thickness of some of the great series embraced in Professor Orton's list is considerably greater in places than it is in Ohio, although his estimate of the thickness of the Carboniferous strata agrees very closely with that developed by the test well at Elizabeth.

Where the stratification is so nearly horizontal for many miles at a stretch as it is along the Ohio River their thickness can only be determined with precision by drilling operations, and drilling operations except for oil and gas in the Carboniferous series of southern Ohio have been infrequent. That there must be several thousand feet of rock exposure along the Ohio River between Pittsburg and the Cincinnati anticline there can be no doubt, while to the west of Cincinnati some of the series noted by Professor Orton above the Silurian reach the surface in a reverse order until finally the coal again appears as is well known in Kentucky, Indiana, and Illinois, below Evansville, Indiana, and Henderson, Kentucky, as shown on good structural maps of the Ohio Valley, etc.

Yours, very truly,

HUGH A. HACKETT,
Professor of Geology, Western University of Pennsylvania.

Maj. WM. L. SIBERT,
Corps of Engineers, Member Ohio River Board, Pittsburg, Pa.

NUMBER 9.

LETTER OF THE MIDLAND STEEL COMPANY.

MIDLAND STEEL COMPANY,
Pittsburg, Pa., April 24, 1906.

DEAR SIR: In reply to yours of recent date forwarded to Midland relative to the use which our company expects to make of the Ohio River, we beg to submit the following:

In the first place we would not have considered a location for our works that was not on the river, as we consider such a location of prime importance in this district.

We are only building 1 blast furnace at the present time, but have drawn our plans with the idea of adding 3 additional blast furnaces and have reserved enough ground so that it is possible to double this number if the future warrants it.

We expect to make coke on our property adjacent to the furnaces and will immediately transport on the river about 250,000 tons of coal per annum for the single furnace. With 4 furnaces and our steel plant completed we would handle about 2,000,000 tons of coal per annum on the river. With 1 furnace we will produce about 150,000 tons pig iron per annum. It is fair to assume that we may ship 25 per cent of this product by river. With 4 furnaces completed and shipping finished steel this percentage might be considerably increased.

We believe that the construction of the ship canal, connecting the Great Lakes and the Ohio River, would be of decided advantage to this district.

Our consumption of iron ore coming entirely from the Great Lakes will be about 300,000 tons per annum for 1 furnace and it is possible with the canal built that almost this entire tonnage would be handled through it. With 4 furnaces our tonnage of iron ore would run about 1,200,000 tons and it would be largely transported through the proposed canal.

If there is any additional information which we can give you which will be of any service we will be very much pleased to have you advise us.

Yours, very truly,

MIDLAND STEEL COMPANY,
J. RAMSEY SPEER,
Vice-President.

Maj. WM. L. SIBERT,
Engineer Office, U. S. Army, Pittsburg, Pa.

NUMBER 10.

LETTER OF THE CARNEGIE STEEL COMPANY.

CARNEGIE STEEL COMPANY,
Pittsburg, Pa., May 21, 1906.

DEAR SIR: Your circular letter of April 11, on the subject of the probable use that we can or will make of an improved river, has not been overlooked, yet the subject is one of sufficient importance to cause us to give it great consideration. After consultation with our various people interested we may summarize our views on the subject as follows:

We do not now nor even with the proposed improvements is it likely we would be able to use the Ohio River on any inbound raw materials, owing to the arrangement of our blast-furnace plants. Consequently the upstream movement would not greatly interest us, except as it will benefit the general community.

On the downstream movement our interests are considerable and if we had a navigable stage of water all the year round in the Ohio River we would no doubt be able to move large tonnages of such materials as steel rails, splice bars, cotton ties, etc. On material for export it is probable that with the opening of the Panama Canal we would be able to use this route for the distribution of our products via New Orleans to Mexico and Central and South American points.

Very respectfully, yours,

H. P. BOPE,
First Vice-President.

Maj. WM. L. SIBERT,
Corps of Engineers, U. S. Army, Pittsburg, Pa.

NUMBER 11.

LETTER OF THE AMERICAN STEEL AND WIRE COMPANY.

AMERICAN STEEL AND WIRE COMPANY,
Pittsburg, Pa., June 22, 1906.

DEAR SIR: Referring to your favor of April 11 in reference to contemplated improvements in channel of Ohio River I regret to advise that on account of your letter being mislaid prompt reply was not given you in this matter.

In this connection would state that we are using river transportation to a considerable extent in the handling of our finished products. We have warehouses established at Louisville, Memphis, and New Orleans, to which we move via barge approximately 50,000 tons of material yearly.

At the present time on account of low water it is possible to move our river tonnage only during certain periods and if the necessary improvements are made in the channel of the Ohio River we feel that the tonnage moved by this firm yearly would be doubled as we could then figure on a regular movement during all months of the year.

Yours, truly,

W. O. DAVIS,
Division Freight Agent.

Maj. WM. L. SIBERT,
Corps of Engineers, U. S. Army, Pittsburg, Pa.

NUMBER 12.

LETTER OF THE JONES & LAUGHLIN COMPANY.

JONES & LAUGHLIN STEEL COMPANY,
Pittsburg, Pa., October 30, 1906.

DEAR SIR: The Jones & Laughlin Steel Company have never used the rivers in this vicinity for the shipment of finished material, as their facilities for so doing have been very limited. They have not felt justified in erecting the necessary docks for river shipment, as the points to be reached by the river are very few except at certain portions of the year. The company brings down annually from their mines located on the Monongahela River about 2,500,000 tons of coal for consumption in their works at Pittsburg. When the Ohio River is completely canalled doubtless the company will be able to ship a large portion of their finished product by river, as about 85 per cent of the finished product goes west.

The company is about to erect four blast furnaces with necessary coke ovens, open-hearth ovens, and blooming mill on the new property recently purchased near Lock No. 4 on the Ohio River. This plant will within a short time consume as much coal as the south side plant and it is the intention to bring all of this coal to the plant by river. The location of this property is ideal for shipment by river and undoubtedly when the 9-foot stage is established large quantities of finished material will be shipped by river.

Yours truly,

B. F. JONES, Jr.

Maj. WM. L. SIBERT,
Pittsburg, Pa.

NUMBER 13.

LETTER OF THE AMERICAN SHEET AND TIN PLATE COMPANY.

AMERICAN SHEET AND TIN PLATE COMPANY,
Martins Ferry, Ohio, July 16, 1906.

DEAR SIR: Your favor of the 7th instant containing a number of questions as to the effect of an uninterrupted 9-foot stage of water in the Ohio River on the manufacturing interests of this valley was duly received.

The questions as propounded are difficult to answer intelligently in connection with the business I represent. The plants of which I have control are La Belle Works at Wheeling, Ætna-Standard at Bridgeport, Ohio, and Laughlin at Martins Ferry, Ohio, all being part of the American Sheet and Tin Plate Company.

The Ætna-Standard and Laughlin Works have landings of their own on the Ohio River. Our raw material being steel bars, which are produced at nearby steel plants, could not well be shipped by river, as the handling to and from the boats of bars would cost more than the present rail-switching rates.

The finished products of these plants amount to over 200,000 tons per annum, practically every pound of which is now shipped by rail. Judging from the experience of years ago when the river was fairly reliable, it is not a wild estimate to predict that with

an assured stage of water and regular lines of boats from 25 to 40 per cent of this tonnage could be shipped by river. The construction of the Lake Erie and Ohio River Ship Canal in connection with the proposed Ohio River improvements would enable the furnaces of this valley to bring unbroken ore cargoes from the upper lake ports direct to their own landings at not over one-half of the freight costs of to-day. This low freight charge, combined with the cheap coal in this section, would result in a continuous manufacturing city from Pittsburg to Moundsville, if not farther south.

It is rather a difficult matter to predict with any accuracy how large the tonnage shipped by river would be, but experience has demonstrated that business grows rapidly with facilities for doing it, and while it is impossible to answer all of your questions as propounded I think it is entirely safe to make a statement that with the Ohio River contemplated improvements completed the tonnage handled by water would be far in excess of the expectations of the most enthusiastic advocates of river improvements.

I trust this information will be sufficient to enable you to compile the data you are trying to secure for Major Zinn.

Very truly, yours,

AMERICAN SHEET AND TIN PLATE COMPANY.
C. A. ROBINSON, *D. M.*

Mr. ROY B. NAYLOR,
Secretary Wheeling Board of Trade, Wheeling, W. Va.

NUMBER 14.

LETTER OF THE MONONGAHELA RIVER CONSOLIDATED COAL AND COKE COMPANY.

THE MONONGAHELA RIVER CONSOLIDATED
COAL AND COKE COMPANY,
Pittsburg, Pa., June 13, 1906.

DEAR SIR: As per your telephone request, the rate and tonnage per barrel of sugar transported in barges from New Orleans, La., to Pittsburg, Pa., in the year 1905–6 is as follows:

Rate, 40 cents per barrel; weight, 350 pounds.

Very truly, yours,
THE MONONGAHELA RIVER CONSOLIDATED COAL AND COKE CO.,
By J. FRANK TILLEY,
Accident and Claims Departments.

Maj. WM. L. SIBERT,
Corps of Engineers, Pittsburg, Pa.

NUMBER 15.

Freight rates on sugar and rice from New Orleans to New York and on coffee from South America to New York, etc., compiled from information furnished by local railroad and steamship agents and the New Orleans Board of Trade.

A. THE OCEAN RATE PER TON MILE FOR SUGAR AND RICE FROM NEW ORLEANS TO NEW YORK.

The estimated water distance from New Orleans to New York is 1,800 miles. The rates are as follows:

	Per ton.	Per ton mile.
Sugar	$5.00	$0.2777
Rice	4.00	.2222

B. THE OCEAN RATE PER TON-MILE ON COFFEE FROM SOUTH AMERICA TO NEW YORK.

The rate on coffee from Rio de Janeiro to New York is 42 cents per sack of 132 pounds, or $6.366 per ton. The steaming distance is estimated at 5,003 miles. The rate per ton-mile therefore is 0.1272 cents.

C. THE RAIL RATES PER TON-MILE ON SUGAR, RICE, AND COFFEE NORTH FROM NEW ORLEANS.

From New Orleans to—	Short-line mileage.	Sugar.		Rice.		Coffee.	
		Per ton.	Per ton-mile.	Per ton.	Per ton-mile.	Per ton.	Per ton-mile.
Chicago	923	$4.60	$0.4983	$5.60	$0.6067	$4.40	$0.4767
Cincinnati	830	3.75	.4518	5.00	.6024	4.40	.5301
Louisville	743	3.40	.4576	4.40	.5922	4.00	.5384
Pittsburg	1,148	6.00	.5249	6.40	.5609	6.40	.5599

The above rates apply to carload lots only. It is supposed that this is what is desired, but in case you wish the rates for less than carload lots the following rates for such shipments are given from which the ton-mile rates can easily be obtained:

To—	Less than carloads.		
	Sugar.	Rice.	Coffee.
	Per cwt.	*Per cwt.*	*Per cwt.*
Chicago	$0.29	$0.32	$0.31
Cincinnati	.25	.29	.31
Louisville	.23	.26	.28
Pittsburg	.37	.37	.37

The short-line routes, the mileage of which are the bases of the above rates, are as follows:

To Chicago.—Illinois Central, New Orleans to Chicago.

To Cincinnati.—New Orleans and Northeastern and Queen and Crescent.

To Louisville.—New Orleans and Northeastern to Meridian, Miss.; Alabama Great Southern to Birmingham, Ala., and Louisville and Nashville to Louisville.

To Pittsburg.—New Orleans and Northeastern and Queen and Crescent to Cincinnati, and Pennsylvania Railroad thence to Pittsburg.

NUMBER 16.

LETTER OF THE PENNSYLVANIA RAILROAD COMPANY.

THE PENNSYLVANIA RAILROAD COMPANY,
Philadelphia, Pa., November 12, 1906.

DEAR SIR: Replying to your favor of the 7th instant, beg to quote you on sugar and rice in carloads from New York, N. Y., to Pittsburg, Pa., 18 and 15 cents per 100 pounds, respectively.

Yours truly,

ROBT. C. WRIGHT,
General Freight Agent.

Maj. WM. L. SIBERT,
Corps of Engineers,
Pittsburg, Pa.

NUMBER 17.

EXTRACT FROM LETTER OF THE PITTSBURG (PA.) CHAMBER OF COMMERCE.

December 12, 1906.

Fluorspar, magnesite and manganese form a large part of the tonnage to the converters in the Pittsburg district. There were imported into the United States during the year ending June 30, 1906:

	Quantity.	Value.
Magnesite:		
Calcined, not purified ..... pounds..	134,526,537	$646,954
Crude ..... do...	27,235,929	93,072
Manganese ore and oxide of not otherwise provided for ..... tons..	225,681	1,786,878

The statement below is from the report of the United States Geological Survey relative to the fluorspar deposits of southern Illinois. This statement tends to prove that should a deep water facility be provided from these fluorspar fields to Pittsburg our domestic production would be able to compete with foreign imports.

The Kentucky-Illinois district is not only the main American source of fluorspar, but is the only one from which spar reaches the general market. Since 1882 the district has produced 260,000 tons of spar having a total value of $1,521,029.

There are no data for determining the production of the Illinois mines separately. For many years they produced practically all the output. Recently the Kentucky mines have been developed and now are producing more than those north of the Ohio. In the following table are given the output and value of fluorspar in the United States for 1902 and 1903, the figures being taken from "Mineral Resources of the United States, 1903."

Production of fluorspar in the United States in 1902 and 1903, by States.

State or Territory.	1902.		1903.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
Arizona and Tennessee	628	$6,872	275	$2,037
Kentucky	29,080	143,410	30,835	153,980
Illinois	18,360	121,532	11,413	57,620
Total	48,018	271,814	42,523	213,617

The spar is shipped in part by the Illinois Central Railroad and in part on the Ohio River. Prices are fixed by Pittsburg quotations less freight and commission. At Pittsburg the American spar comes into competition with English and German material imported through New York. The American mines supply the western trade and about half the Pittsburg demand. The importers control the eastern trade and determine prices at Pittsburg.

There are three main uses for fluorspar. The highest grade, running less than 1 per cent of silica and white in color, is sold either ground or in lump for use in the enameling, chemical, and glass trades. It brings the highest price, recent New York quotations being $8 to $10 a ton unground and $11.50 to $13.50 ground. The price at the western mines is about $1 less per ton than the New York price to offset differences in freight rates to competing territory. There is a limited market for this grade of spar and it probably would not be extended much even at lower prices, since the amount used is determined by conditions wholly outside the cost of the spar. On the other hand it is a question whether even a higher price could not be obtained for this grade.

The second grade of spar is used in steel making and is sold unground as lump or gravel. It includes colored spar and may run as high as 4 per cent silica, though mostly sold with 3 per cent guaranty. It is demanded for open-hearth work because of the great fluidity which it gives the slag. At present at least 20,000 tons are used annually in this work at a cost to the user of

from $6 to $8 per ton. Importers have now a slight advantage in the Pittsburg market on this grade of ore. It is probable that when a steady supply of fluorspar at the present or slightly lower prices can be guaranteed in steel-making centers the market can be rapidly expanded and this affords the most hopeful outlook for spar producers. In many ways fluorspar has advantages over other fluxing materials now used.

The lowest grade of spar, including all running over 4 per cent silica, or spar mixed with calcite, can be used in foundry work, and while the price is and always must be low, there is possible an almost unlimited market. It is probable that systematic efforts to introduce the low-grade material into this trade would be highly beneficial to the industry as a whole. While there would be little profit in mining foundry spar it would allow the production of No. 2 spar in quantity and at prices demanded by steel makers. With the exhaustion of Bessemer grades of iron there will be an increased demand for fluorspar, though even now demand is ahead of supply for steel-making grades. Since at any increase in prices it becomes cheaper to use less sufficient fluxes, it follows that while the output can be increased prices probably can not be much changed.

With these facts in mind it is seen that the fluorspar mines of the Kentucky-Illinois district will have for many years a large and growing market to supply. Their only competitors are the importers and competition with them is mainly a matter of transportation costs. It is not certain that this competition will always be as keen as now, since foreign producers have an important and growing trade outside of the United States. Mines in the Rocky Mountain region and other western States can not be expected to disturb the fluorspar market. Such fluorspar as occurs in connection with the ores of that region will probably always have a sufficient local market. The quantity present is not important in any western district yet described and local smelters make an allowance for lime, which entirely aside from the cost of transportation is likely to prevent shipments of spar to the East.

APPENDIX III.

LETTERS FROM BOARDS OF TRADE, COMMERCIAL CLUBS, PROMINENT MANUFACTURERS, ETC.

LETTER OF THE LOUISVILLE (KY.) BOARD OF TRADE.

I have the honor to present to you a statement giving the information gathered at your request by the board of trade relative to the tonnage, chief industries, and general business of the city of Louisville, which you desire to attach to the report of the Board of Engineers bearing upon the improvement of the Ohio River when said report is submitted to Congress.

In giving you and the Board of Engineers the information asked for it has been deemed advisable to follow as closely as practicable the six questions presented by you.

Question 1.—What is the total outgoing and incoming tonnage of freight for the city?

The board of trade has interpreted this question to refer only to freight tonnage which originated at or terminated at Louisville, and the statement herein showing inbound and outbound tonnage by the railroads and the river does not include any of the vast freight tonnage which merely passes by or through the city and which originated at points and was consigned to points other than the city of Louisville.

This through tonnage is of course very great, as Louisville is the principal gateway on the river between the north and the south and nearly one-half of the tonnage passes through it.

Actual inbound and outbound tonnage at Louisville, 1905.

	Inbound.	Outbound.
Total by railroads.....tons..	4,812,635	3,395,747
By river:		
Up river.....do...	74,830	58,102
Down river.....do...	99,006	66,004
Total by river.....do...	173,836	124,106

It is proper that I should call your attention to the fact that the statement as to river tonnage includes only the freights carried by packets and other steamboats which stop at the city wharf and which have reliable records as to freights carried and does not include the enormous tonnage carried in barges such as coal, iron, sand, cement, lime and other commodities, about which I could not secure data deemed reliable enough to include in this statement.

Question 2.—What are the chief industries of the city?

This question by reason of questions 3 and 4 following it is interpreted to refer to manufacturing industries.

Louisville's chief industries are the manufacture of agricultural implements and wagons; cast-iron pipe and bar iron, enameled bath tubs and brass and iron plumber's supplies: Staves and castings, clothing, leather, woolen goods and yarn, fertilizers, harness and saddles, refined vegetable oils and soap, flour, vinegar and pickles, lumber and boxes, structural iron, tobacco, furniture, terra cotta and tile, white lead and paints, wire goods, boilers and ice machines, whisky, packing-house products, machinery, wooden ware and brooms, cooperage and staves, candy.

Question 3.—"What are the sources of supply of raw material used in these chief industries?"

Question 4.—"How much if any of this raw material comes from abroad?"

The great proportion of the raw material, both as to quantity and value, used in the industries referred to comes from Kentucky and the States surrounding it and but a very small and almost an unappreciable quantity comes from abroad. The pig iron comes principally from Alabama and Tennessee, though some comes from Pennsylvania and West Virginia. In wood-working industries the timber and lumber comes from Kentucky, West Virginia, Tennessee, Alabama, Mississippi, Michigan, and other portions of the central section of the country. A very large business has grown up here in the last few years in the importation of mahogany logs from Honduras and other parts of Central America and these logs are here made into fine lumber. This branch of business is growing rapidly. The mahogany logs are received at Pensacola and New Orleans and shipped to Louisville in all cases by railroad.

The tobacco for manufacturing comes to a very large extent from Kentucky, Indiana, Illinois, Tennessee, though some comes from Virginia, West Virginia, and Ohio and a very little from outside the United States.

The whisky is made from grain produced in Kentucky and the grain-producing States. The refined vegetable oils and soap are made from cotton seed and crude oils coming from the cotton States to the south and southwest of Kentucky. The cured meats and packing-house products are made from cattle, hogs, and sheep received from Kentucky and surrounding States.

The flour manufactured here is made from the wheat of Kentucky and surrounding States to large extent, though some comes from Iowa, Kansas, and Nebraska.

Louisville makes large quantities of leather, about 98 per cent of the hides used being American hides and 2 per cent coming from South America by way of Europe.

This city ships out annually more than 1,500,000 barrels of cement of 265 pounds per barrel. The manufacture of lime is important, one firm alone shipping annually more than 25,000 tons. These articles are made from raw material secured at or near Louisville and the foreign element in their production is not appreciable.

The woolen goods and yarns are made from raw products of American production and without foreign material.

Louisville is now an important manufacturing point and is growing rapidly in manufactures and taking all lines together it is safe to say that in quantity and value the amount of foreign raw material used here is not appreciable.

Question 4 (continued).—"What effect will an uninterrupted river transportation—from New Orleans to Pittsburg—have on such imports?"

As the imports which enter into manufacturing at Louisville at the present time are of small consequence the results from uninterrupted river transportation would not be great, except perhaps in the case of mahogany logs from Central America by way of New Orleans.

Question 5.—"What effect on the manufacturing industries generally will an uninterrupted river traffic have, both as to bringing together of the raw materials and to the distribution of the finished products?"

It is difficult to estimate the great and beneficial effects upon the manufacturing industries of Louisville that will surely come from an uninterrupted river

traffic. Nearly all of the heavy raw materials such as iron, pig and bar, timber, lumber, hides, fuel, etc., which can be had close to waterways can then be delivered at Louisville at all times of the year by uninterrupted river voyage. Contracts can be made for the purchase of such supplies based on the charge for river transportation and with confidence that the river will be open for such transportation. For the distribution of the finished products the benefits will be even greater. The best markets for the major part of products of Louisville factories lie to the south and southwest of us and are reached by the waterways and if these waterways were made so that navigation would be uninterrupted at all seasons of the year the products could be delivered at the markets now taking them at a cheaper rate than now and foreign markets would soon be found for valuable trade in our commodities.

With a deep and uninterrupted river the number of steamboats and barges would multiply one hundred fold. The cost of a steamboat is large and people will not at present invest money to a great extent in a property that can work only one-half of the time. With open river the year round the boats and barges would quickly come and shippers would patronize them, for contracts could be made for future deliveries with a knowledge that the river would be open and delivery made. With deep water and uninterrupted navigation from Pittsburg to New Orleans and the opening of the Panama Canal Louisville and the whole Ohio Valley can send the products of their factories and fields into good foreign markets.

Uninterrupted river navigation will also undoubtedly bring good results to manufacturers and shippers generally in reducing railroad rates which in many cases are now too high.

Question 6.—"What are the present receipts and shipments by river?" (separating if possible upstream an downstream).

This question has been answered above—where the inbound and outbound river tonnage is given—and has been separated into up river and down river.

I also forward you herewith as part of this report a statement of receipts and shipments of certain named commodities for the year 1890 and for the year 1900 for comparison, which shows the large increase in these industries.

The statements as to tonnage by railroads and river are for the year 1905, and include Louisville business (tonnage) only as stated.

Statement taken from the records of the Louisville Board of Trade showing receipts at and shipments from Louisville, Ky., of certain leading articles named for the calendar years 1890 and 1905 for comparison—other commodities not enumerated below show increase in about same proportion.

[The statement shows Louisville business only and does not include through business.]

	Receipts.	Shipments.
Agricultural implements:		
1905.....pounds..	12,013,264	60,047,536
1890.....do....	6,298,943	16,370,990
Increase.....do....	5,714,321	43,676,546
Boots and shoes:		
1905.....cases..	113,977	119,607
1890.....do....	104,496	61,897
Increase.....do....	9,481	57,710
Canned goods:		
1905.....do....	468,502	647,597
1890.....do....	178,548	107,557
Increase.....do....	289,954	540,040
Coffee:		
1905.....pounds..	10,102,279	9,484,873
1890.....do....	5,906,582	4,612,404
Increase.....do....	4,195,697	4,872,469
Dry goods:		
1905.....packages..	628,363	877,941
1890.....do....	79,908	100,074
Increase.....do....	548,455	777,867

Statement taken from the records of the Louisville Board of Trade showing receipts at and shipments from Louisville, Ky., etc.—Continued.

	Receipts.	Shipments.
Furniture:		
1905.....pounds..	8,593,554	47,178,973
1890.....do....	5,213,108	13,218,354
Increase.....do....	3,380,446	33,960,619
Flour:		
1905.....barrels..	211,263	862,581
1890.....do....	163,871	179,005
Increase.....do....	47,392	683,576
Corn:		
1905.....bushels..	10,581,130	8,212,063
1890.....do....	8,167,007	5,239,709
Increase.....do....	2,414,123	2,972,344
Oats:		
1905.....do....	5,265,502	3,787,430
1890.....do....	2,663,083	1,718,060
Increase.....do....	2,602,419	2,069,370
Wheat:		
1905.....do....	4,924,295	1,313,155
1890.....do....	777,664	226,578
Increase.....do....	4,146,631	1,086,577
Hardware:		
1905.....packages..	235,882	1,230,681
1890.....do....	45,015	143,768
Increase.....do....	190,867	1,086,863
Hides:		
1905.....pounds..	21,256,258	6,092,548
1890.....do....	11,486,759	2,455,151
Increase.....do....	9,769,499	3,607,397
Leather:		
1905.....do....	----------	11,495,320
1890.....do....	----------	----------
Increase.....do....	----------	11,495,320
Packing-house products:		
1905.....do....	26,830,151	83,898,176
1890.....do....	11,775,547	22,577,859
Increase.....do....	15,054,604	61,320,317
Pig iron:		
1905.....tons..	113,496	12,088
1890.....do....	58,794	668
Increase.....do....	54,702	11,420
Machinery:		
1905.....pounds..	9,432,082	14,764,651
1890.....do....	5,016,734	5,478,131
Increase.....do....	4,415,348	9,286,520
Nails:		
1905.....kegs..	190,837	178,907
1890.....do....	158,016	84,506
Increase.....do....	41,821	94,401
Cotton-seed oil:		
1905.....barrels..	331,245	325,792
1890.....do....	13,874	19,825
Increase.....do....	317,371	305,967

Statement taken from the records of the Louisville Board of Trade showing receipts at and shipments from Louisville, Ky., etc.—Continued.

	Receipts.	Shipments.
Apples, onions, and potatoes:		
1905.....barrels..	327,192	488,343
1890.....do....	176,277	188,384
Increase.....do....	150,915	249,959
Seed, garden and grass:		
1905.....pounds..	9,617,478	8,149,462
1890.....do....	6,607,359	5,991,552
Increase.....do....	3,010,119	2,157,910
Stoves and hollow ware:		
1905.....do....	5,372,671	37,177,491
1890.....do....	1,755,181	16,877,479
Increase.....do....	3,617,490	20,300,012
Soap:		
1905.....do....	12,448,641	22,927,958
1890.....do....	2,745,183	2,257,670
Increase.....do....	9,703,458	20,670,288
Sugar:		
1905.....barrels..	170,950	146,951
1890.....do....	102,315	55,141
Increase.....do....	68,635	91,810
Tobacco, unmanufactured:		
1905.....hogheads..	152,892	113,730
1890.....do....	84,078	86,801
Increase.....do....	68,814	26,929
Tobacco, manufactured:		
1905.....pounds..	1,320,045	64,662,813
1890.....do....	1,049,636	21,147,847
Increase.....do....	270,409	43,514,966
Terra cotta and tile:		
1905.....do....	33,808,905	78,827,300
1890.....do....	6,187,256	7,410,030
Increase.....do....	27,621,649	71,417,270
Vinegar:		
1905.....barrels..	27,887	137,443
1890.....do....	1,788	26,967
Increase.....do....	26,099	110,476
White lead, paints, etc.:		
1905.....pounds..	12,921,768	26,141,561
1890.....do....	3,384,241	4,003,492
Increase.....do....	9,537,527	22,138,069
Wagons:		
1905.....do....	9,657,343	35,376,615
1890.....do....	1,732,014	10,898,552
Increase.....do....	7,925,329	24,478,063
Whisky:		
1905.....barrels..	164,001	467,868
1890.....do....	71,005	277,665
Increase.....do....	92,996	190,203
Wooden ware:		
1905.....pounds..	26,887,957	54,981,561
1890.....do....	2,455,629	2,400,100
Increase.....do....	24,432,328	52,581,461
Woolen goods and yarns:		
1905.....do....	3,217,205	20,489,914
1890.....do....	1,332,626	4,854,632
Increase.....do....	1,884,579	15,625,282

LETTER OF THE CINCINNATI (OHIO) CHAMBER OF COMMERCE AND MERCHANTS' EXCHANGE.

Referring to your recent inquiries having a bearing upon our river traffic and what should be expected of the future under betterment of our great waterway, so as to provide for as nearly as possible uninterrupted transportation facilities, I submit such conclusions as the brief opportunity at my disposal at this time seems to admit of.

You have submitted six questions as coming from the statistical committee of a board of engineers of the United States Army Corps, to which I will direct my attention.

No. 1.—"What is the total outgoing and incoming tonnage of freight" (by Ohio River)?

Our records are not sufficiently complete to admit of a definite statement, but it is reasonable, in the light of evidence from available records as a basis for general deductions, to suggest that it is about 4,500,000 tons annually.

No. 2.—"What are the chief industries of the city?"

Manufacture of clothing, boots and shoes, vehicles, furniture, office, bank and bar furnishings, woodworking machinery, machinery in very great variety and extent, machine tools, leather, harness and saddlery, distilled and malt liquors, pork and beef products, pianos, soap, lumber, metal products in great variety, printing ink, and many other lines of importance. Jobbing operations embrace groceries, dry goods, hardware, and all the lines usually found in a large commercial center.

No. 3.—"What are the sources of supply of raw material used in the chief industries?"

Lumber, cut, comes from regions up the river and southward, that from the South by rail—from Tennessee and adjacent regions, etc. Uncut lumber comes largely from eastern Kentucky, West Virginia, etc. Coal comes from the Pittsburg district and West Virginia by water, rail receipts including supplies from southeastern Ohio, Virginia, etc. Pig iron comes from Alabama, southeastern Ohio, etc. Animals for slaughtering come from Indiana, Illinois, Ohio, Kentucky, and Tennessee. Leather comes largely from eastern sources, but it is not a prominent local product. Grain for distilling and brewing concerns comes from Indiana, Illinois, Iowa, Wisconsin, Ohio, Kentucky, etc. Cotton-seed products and other material for soap manufacture and other purposes come from Tennessee, Georgia, and other southern localities. The greater part of the raw material comes from districts along and adjacent to the Ohio Valley and southward.

No. 4.—"How much of the raw material comes from abroad? And what effect will an uninterrupted river transportation have on such imports?"

Can not speak with definiteness, but of much less importance than from domestic sources as to present extent of such business. But with uninterrupted water transportation and the relatively low cost of freight which this implies business experience teaches us that a very important change in the direction of increased movement of such products would result beyond question.

No. 5.—"What effect on the manufacturing industries generally will an uninterrupted river traffic have, both as to bringing together of the raw materials used and to the distribution of the finished products?"

The Ohio Valley region through its resources for raw materials entering into industrial operations and by its agricultural characteristics is naturally a freight-producing section of the highest class in this country. These resources have been only partially developed and are capable of very great expansion in extent of output. Probably no application of human activity in any other manner could do more in promoting such development and expansion than the betterment of conditions for moving freights in the Ohio River and its tributaries. The benefits derivable from such facilities of uninterrupted commerce would be far-reaching, not only with reference to enlargement of production and of distribution of domestic products in all this section of the country, but likewise in its influence upon imported products and their distribution by the facilities afforded by regular and continuous traffic.

No. 6.—"What are the present receipts and shipments by river?"

Coal, lumber, animals, tobacco, liquors, salt, iron, produce, etc., and merchandise of all kinds.

I regret that time now at disposal does not favor a more complete treatment of the questions presented, and which I am sure are of such importance in an

early and future influence upon our industrial interests as to justify the most favorable consideration of the Government, to the end of advancing as rapidly as possible the work of securing continuous navigation.

LETTER OF THE CINCINNATI (OHIO) CHAMBER OF COMMERCE AND MERCHANTS' EXCHANGE.

In reply to your inquiry concerning the volume of traffic at Cincinnati represented by receipts and shipments of freight by railway lines, it has not been possible to secure from such transportation lines statements representing tonnage of freight for some of the companies, so that only partial returns have been available in this particular. For several years we have annually secured reports from a large proportion of such business from which we have formed approximations for the unavailable portion, thus reaching conclusions deemed to be justified by such indications. Accordingly it has been made to appear that for the calendar year of 1905 the railway traffic in and out of Cincinnati was 23,000,000 to 25,000,000 tons.

Referring to my communication to you under date of July 11, 1906, relating to the share of the Ohio River freight traffic which Cincinnati represents, I remarked that while a definite statement could not be offered, it was reasonable, in the light of evidence from available records as a basis for general deductions, to suggest that such traffic represents about 4,500,000 tons annually. This would mean that the river business represents about 16 per cent of the combined tonnage by rail and river.

While this is as far as I may need to go in replying to your inquiries, I shall assume to add a few observations upon questions indirectly related to the propositions under consideration. I feel that it may be assumed that wherever rests the controlling power concerning a condition, or a force, or a property applicable to the public or general welfare, there is an implied obligation on the part of such power to furnish to the welfare interests everything that is practicable, feasible, and deserving, calculated to be promotive of such interests. The Government has charge of navigable waterways because they are open public thoroughfares for purposes of commerce and transportation, unrestricted by local or State limitations. The Ohio River is one of the especially great thoroughfares of such nature. It has been well shown that this water course and its tributaries are within territory of the highest order of productive power in relation to agriculture as well as of resources of forest and mineral products, and in its position for encouraging manufacturing enterprise for utilization of raw materials for products available for distribution in all portions of our country and to foreign markets. In these matters this territory has had but partial development. The development of such resources and opportunities is dependent upon relatively advantageous transportation facilities. Water transportation represents a much lower cost of movement of freight than does the railway. The two systems of transportation work together and serve each other, and the combination serves the interests of the producer and consumer. The railway facilities in this region have advanced far more than the water facilities for transportation, notwithstanding the fact that water transportation represents the lower element of cost, and thus contributes significantly to the growth of business and industry. The people in the Ohio Valley region are justified in regarding with great satisfaction the recognition which has already been accorded to the benefits to be secured from betterment of the navigation of the Ohio River, under the plan for continuous service throughout the year. They are justified in manifesting full appreciation of all that has been accomplished and provided for, in this direction. They are likewise justified in continuance of urgent appeals to the Government having the control over these waterways, to more nearly keep pace with the demands for betterment of such transportation facilities, and to more closely approach the advance made in such matters by the enterprise of the railway interests. While full consideration should be accorded to the position of the Government in its relation to such work in this region and elsewhere, with reference to power for effecting rapidity of progress, the fact remains and should not be lost sight of that effectiveness of results which are promotive of the real objects in view depends much upon the rapidity of progress in such work. It is not too much to say

that no section of our country presents stronger evidences of opportunity for securing needful and beneficial results to industrial interests than now lies in the power of the Government through ample provisions for improvement of the navigable waterways of the Ohio Valley region.

LETTER OF THE WHEELING (W. VA.) BOARD OF TRADE.

I learn from M. Marsh & Son, large stogie manufacturers, and Bloch Brothers, tobacco manufacturers, that the larger part of their raw materials comes from Kentucky. The stogie makers also use Ohio, Pennsylvania, and Connecticut tobacco. The Kentucky product is now shipped here entirely by rail, but improvement of the Ohio River might have a tendency to increase river shipments.

All the iron ore used in furnaces by the mills in this section comes from the Lake Superior region. The La Belle Iron Works owns its mines outright, the Wheeling Steel and Iron Company is interested in several mines, while the Steel Corporation furnaces get their ore from their own mines. It is the expert opinion that the Erie Ship Canal would aid very largely in getting supplies here cheaply.

The principal raw materials in the manufacture of glass are sand, niter, soda ash, and lime. The sand comes from Pennsylvania, West Virginia, and Ohio; the niter comes from South America by way of Baltimore, New York, Philadelphia, and New Orleans; the soda ash was formerly made in England, but American manufacturers are now supplying the country and there are now six or eight plants located in Michigan, Virginia, New York, and Ohio.

The lime comes principally from northern and central Ohio.

The improvement of the Ohio River would probably aid in the assembling of these raw materials.

LETTER OF THE POMEROY (OHIO) BOARD OF TRADE.

The permanent improvement of the Ohio River will be very far reaching in its benefits. There is scarcely an interest or any of the people of the entire country who do not depend in some way upon the workshops or mines of our Ohio Valley; and to get out products to the market by the most economical means is of importance to all.

With a regular navigable stage of water in the Ohio River, it is difficult to estimate the extent to which it will increase the tonnage movement from our territory. Pomeroy contributes no small amount to the traffic of the Ohio River, Our principal industries are the production of salt and the mining of coal. A leaflet issued by our board of trade in the year 1901 gives the tonnage of these commodities shipped by river from this point, as follows:

Annual coal shipment by river	bushels	3,000,000
Annual salt shipment by river	do	2,250,000

With the improvement of the Ohio River this tonnage would no doubt be increased many fold. Meigs County, of which this place is the county seat, contains the largest undeveloped coal field in the State of Ohio. This coal field underlies the eastern and southeastern parts of the county, all of which territory lies contiguous to the Ohio River for a distance exceeding 60 miles. The coal lies at a depth ranging from a few feet to nearly 300 feet, a solid block of more than 50 square miles of coal, of a thickness of more than 4 feet. One hundred thousand acres of coal, each acre comprising more than 100,000 bushels.

As to the quality of the Meigs County coal, I quote from the geological survey of Ohio, volume 5, page 737, where Mr. Emerson McMillin, in an article on "The gas coals of Ohio," has this to say: "All things considered, the coal from Antiquity, near Pomeroy, Meigs County, No. 8, or Pittsburg seam, is the best gas-making coal of any that has yet been tried in the State. Fair yield, high illuminating power, easily purified, and producing a good coke; these facts put this at the head of the list of Ohio gas coals."

With the large Ohio River frontage bordering upon this coal field, it will be seen what a powerful influence the improvement of this river will have upon the future development of the coal industry in this locality, adding millions of tons annually to the river traffic.

In addition to the wealth of Meigs County in salt and coal, there also exists an abundance of clay suitable for the manufacture of pottery and tiling, and for the making of brick, both building and paving.

Petroleum has been produced in marketable quantities for a number of years, and, judging from the large area under lease, large developments along this line may reasonably be looked for at no distant date.

It is apparent to anyone familiar with the natural resources and industrial activities of the Ohio Valley that with the river improved it will become one of the greatest freight carriers in the world. It is my opinion that the people of the United States are becoming alive to the necessity of river and harbor improvement generally, and that there is now a sufficient sentiment aroused to justify Congress in making more liberal appropriations to prosecute such work. The result of the improvements made on the Great Lakes is an example of what it would mean to the Ohio River, and I trust we may have river and harbor legislation to the end that your work may be pushed to an early completion.

LETTER OF THE CLOVERPORT (KY.) COMMERCIAL CLUB.

Yours of the 28th ultimo received, and we respectfully submit the following data which we have collected with not a little trouble and considerable delay:

Question 1. What is the total outgoing and incoming tonnage of freight?

Answer. About 12,423,854 tons per annum.

Question 2. What are the chief industries of the city?

Answer. Tobacco, timber, foundry, railroad shops, brick manufacturing, roofing and tiling, ice and water company, electric light company, Polk Canning Company, sawmill company, planing mill company, coal company, flour mill, job printing company, Phelps-Mussel Shell Company.

Question 3. What are the sources of supply of raw materials used in these chief industries?

Answer. Home and foreign, 90 per cent from home.

Question 4. How much, if any, of this raw material comes from abroad? What effect will an uninterrupted river transportation (from New Orleans to Pittsburg) have on such imports?

Answer. Ten per cent from abroad. It would decrease the freight rates through competition with railroads and increase the imports considerably.

Question 5. What effect on the manufacturing industries generally will an uninterrupted river traffic have, both as to bringing together of the raw materials and to the distribution of the finished products?

Answer. It would increase the manufacturing industries at least 100 per cent, thereby increasing the use of raw materials here and from abroad and consequently the distribution of the finished product in the same proportion.

Question 6. What are the present receipts and shipments by river?

Answer. About 180,000 tons per annum. There should be added in answer No. 3, home—and these are tobacco, corn, tomatoes, wheat, fruits, clays, timber, coal, and lumber; foreign—coke, pig iron, pine lumber.

LETTER OF THE HANLON-SHARPS COMPANY (PAPER), OF WHEELING, W. VA.

Answering your letter of the 7th instant, uninterrupted river traffic would be of great advantage to us in our business. It would not materially aid us in bringing together raw material. The advantage would be in shipping the finished product.

We think undoubtedly that a regular navigable stage of water would certainly lead to the establishment of new industries in this field.

The increase in river traffic would, in our opinion, be at least 40 per cent if a navigable stage was had the year round.

The construction of the Lake Erie and Ohio River Ship Canal would benefit the Wheeling district very materially, especially the iron business, as we see it.

Hope that you may be able to push this river improvement through with all speed possible, and assure you that we are greatly interested in the subject, and regret that your previous letter was not answered.

LETTER OF D. H. BALDWIN & CO. (PIANOS), LOUISVILLE, KY.

We have your favor of the 14th in regard to the benefit that the Ohio River is to our business, and the advantage that would obtain to us could we have a 9-foot river navigation.

Our river tonnage last year received from Cincinnati, destination to Louisville, was in the neighborhood of 200 tons. This, as you know, being on the highest class and highest rate of freight, pianos.

We sent only a few tons of freight from here, about ten, as there is no service except in the last month south of this point, except some local stations between this city and Evansville. We ship to all sections of the United States and to about 35 foreign countries.

We consider that our facilities from Cincinnati to Louisville, by boat, are the greatest we have in the world, from the matter of the time that is made and the matter of satisfaction given to us in the shipment. Our goods arrive in perfect condition, and we have never had a complaint from damage by water or rough handling. On the other hand, where shipments are made to other points by railroad, we have trouble of every kind, from exposure to the weather and rough handling. Could we have proper river facilities from Louisville to New Orleans, we could handle 1,000 tons every year at once, and from what little experience we have had the river facilities on the question of time are much better than railroads. We take as a sample shipments to Memphis and below.

We consider that it would be of the greatest benefit to our business of anything that could be bestowed upon us at the present time, both for taking care of and opening up an immense southern trade, as well as allowing us to take care of an immense foreign trade and on the Pacific coast.

LETTER OF THE LA BELLE IRON WORKS, OF STEUBENVILLE, OHIO.

The receipt of your favor of the 7th instant is hereby acknowledged, and I beg to submit the following replies to your questions, taking them up in the order in which they are given:

First. An uninterrupted waterway from Pittsburg to the Gulf, with a minimum stage of 9 feet above Cairo, would unquestionably be of untold advantage to all manufacturing industries located along the Ohio River; this is for no other reason than the influence such a waterway or means of cheap transportation would have on railroad rates. Wheeling's present favorable freight rates to river and near river points are largely owing to the wholesome regard in which water transportation is held by railroad managers; but with an improved waterway admitting of still lower water rates a further reduction in the rail freights could naturally be expected. Besides this, on long-haul points a water rate could be made against which the railroads could not compete, thus giving to the river shipper an advantage over his competitor who must depend altogether on rail transportation.

But a waterway to be of service to shippers must be adequate as well as reliable, and unless the river is made navigable for at least eight to ten months in the year, it is not of much benefit as a means of transportation. With the opening up of the Panama Canal the benefits to be derived by river shippers will be greatly enlarged.

Second. It is difficult to say what advantage an uninterrupted river traffic would have on the question of imports to this country, but with the depletion of Minnesota ore lands other ore deposits will have to be discovered, and these in all probability will be found in Mexico or some other southern country, where water transportation can be utilized to great advantage.

Third. It is a well-known fact that manufacturing industries, like other things, are the most numerous where they thrive the best.

Fourth. It is out of the question to estimate with any degree of accuracy what increase would take place in river traffic, provided we had a 9-foot stage of water open most of the year, but it would undoubtedly be several thousand per cent.

Fifth. The construction of the Lake Erie and Ohio River Ship Canal would certainly benefit Wheeling and vicinity as much as any other locality, bringing about lower freight rates on ore from the Northwest, and on coal and other commodities to the same section.

It certainly stands to reason that the natural advantages enjoyed by any locality should be improved and utilized, and it will be a matter of wonderment to those who follow us in years to come why this question of river transportation was not worked out sooner, and why the very people who should be the most interested were apparently so indifferent.

LETTER OF HOUSE & HERRMANN (OUTFITTERS), OF WHEELING, W. VA.

I have received a communication from the Secretary of the Wheeling Board of Trade, requesting an opinion on the advantages that would accrue to our manufacturing and business interests by having an uninterrupted 9-foot stage of water in the Ohio River from Pittsburg to Cairo.

Generally speaking, the benefits could not be computed, they would be incalculable.

But to answer your questions as laid down:

First. The effect of an uninterrupted river traffic in the bringing together of raw material would be to stimulate the production of same. The demand would be so much greater here, because the saving in freight charges, when compared to railroad cost of handling heavy freight, would place our iron, steel, and tin industries to much better advantage to better compete with the world's markets, both as to quality of the finished products, and the means of getting it to the seaboard for shipment abroad, via the Mississippi River and St. Lawrence River.

The advantage of a 9-foot stage would not, however, materially increase our facilities for obtaining raw material from the Lake districts, unless the Lake Erie and Ohio River Canal was built to make an unbroken chain in water transportation for both the raw material and the distribution of the finished product.

Second. A regular navigable stage would certainly increase the number of our industries. What will benefit already established industries, must naturally provide a field of profit for new ones.

Third. Regarding the percentage of increase in traffic following an uninterrupted navigable stage, this can only be answered by conjecture. In the first place, it would naturally increase in the ratio as the traffic is now on a regular stage. In other words, if we now have an interrupted stage for six months, an uninterrupted stage for twelve months would double the traffic, to say nothing of the gain accruing from the loss due to the interrupted stage of six months.

Confidence begets business. As it is now we derive only the benefits of the interrupted six months navigable stage from such shipments as can wait for navigable stages. Who knows, who can compute, the tremendous tonnage that must be moved to fill immediate orders?—which could be shipped by water if a dependable stage could be had from January 1st to December 31st. This same tonnage is now congesting our railroad facilities; it is menacing life and property, due to this freight congestion.

The increase of business in this Ohio Valley would make up for the loss of heavy, cumbersome freight on railroads, by providing freight of other character, due to the increased population.

The effect of the railroads carrying the cumbersome freight (raw and finished material of our heavy products) is to delay and deter the shipment of perishable merchandise. So that the per cent of increase would probably be 200, and as our industries increased would be five times as much as now.

I can only cite you the example of the benefits to Glasgow, Scotland, accruing from the deepening of the channel of the Clyde, which doubled the shipping of that port in short order, yet did not detract business from the other ports.

The same applies to the Manchester Ship Canal, which was built at a cost of $40,000,000 for the express purposes of saving one-eighth of 1 per cent in the freight charges of cotton, etc., from Liverpool to Manchester. This has not only proved to be a money saver for Manchester manufacturers, but a good investment for the various municipalities which invested large sums therein. I have no doubt that the completion of the Ohio River improvements, and of

the Lake Erie Canal, which, by the way, I look on as a necessary adjunct, will make the Ohio River Valley the workshop of the world, endowed as it is with all of the requisites, such as coal, gas, oil for the lowering of the cost of production of anything usable. The only thing we lack is the low cost of getting our products to the seaboard and our heavy raw material to our mills. This can be obtained by the completion of the Ohio River improvements and the Lake Erie Canal.

LETTER OF THE SCOTT LUMBER COMPANY, OF BRIDGEPORT, OHIO.

In reply to yours of April 6, in reference to the 9-foot stage and its effects on the commerce and industries of the valley, will say, first—

That an uninterrupted 9-foot stage the year round would increase the freight carrying in our line (lumber) very greatly upon the river, as in the summer season, when the river is low, is the time when the trade is heaviest in building material. The lumber could be brought from the South in its raw state and manufactured and distributed up and down the Ohio River cheaper than any other way. This answers the second question as well.

It is my opinion that a regular navigable stage would cause many new industries to locate along the Ohio River, as the section between Pittsburg and Cincinnati is exceptionally favorable, owing to the coal works, good shipping facilities, and, last but not least, it is of great importance to have plenty of good water in all manufacturing plants.

It is my opinion that the trade on the Ohio River would be many times heavier, possibly five times as heavy in ten years as it is at present. In fact, it is hard to estimate as we can not count on how many large iron works, coal plants, etc., would equip themselves with barges, if they could depend upon navigation the year through; we might see twenty times more freight carried in ten years than there is at present. I see no reason why all the large iron works, glass factories, coal mines, and potteries should not have their quota of barges and transfer the greater part of freight that goes South in export trade, by way of New Orleans.

Another factor that might cut an important figure is the South American trade that we are not counting on at present. All these taken into consideration make it hard to estimate the increase.

As to the last question in regard to the Lake Erie and Ohio River Canal, I am unable to say anything.

It is my great desire, both individually and as a member of our firm, that this 9-foot stage come early, as I am surely of the opinion that nothing will do the Ohio Valley more good in most every way than its completion.

LETTER OF THE WHEELING POTTERIES COMPANY, OF WHEELING, W. VA.

In reply to your circular letter of inquiry of the 6th instant, will answer your questions in the order in which they are asked.

First. An uninterrupted water supply would naturally be advantageous for manufacturing industries, as we could then depend upon river traffic for shipping and receiving material and finished products, and naturally would cultivate that method of shipment, which, as far as we are concerned, at the present time is hardly ever used by us, as steamboat facilities are so uncertain.

Second. We are large consumers of imported clays, which are now shipped from New York, Philadelphia or Baltimore by railroad. With a uniform stage of water this could all be unloaded at New Orleans and shipped by river.

Third. With the increased facilities of water navigation in connection with our splendid railroad facilities, a regular navigable stage of water should undoubtedly be conducive to the establishment of new industries in this locality.

Fourth. It would be hard to estimate the percentage of increase in traffic, but undoubtedly it would be quite considerable.

Fifth. The construction of the Erie and Ohio River Canal would be fully as advantageous to this district as an uninterrupted river traffic would be, and the two combined should undoubtedly make the Wheeling district one of the best manufacturing centers in the world.

LETTER OF S. J. HATHAWAY (LAWYER), OF MARIETTA, OHIO.

In view of the proposed improvement of the Ohio River by securing a depth of 9 feet and my attention having been called to the action of Congress, seeking more definite information as to the effect such improvement would have on the business of the Ohio Valley, I wish to say that under present conditions at low-water stage, such as prevails almost uniformly during the summer months, the through traffic is entirely suspended and the large steamers such as the *Virginia, Key Stone State, Queen City* and other steamers plying between Cincinnati and Pittsburg have to lay up until the fall rains again bring the river up to a boating stage. Of course, the same conditions prevent any traffic whatever by the immense coal fleets.

The above statement is true also in regard to the steamers plying between Charleston, West Virginia, and Pittsburg, via the Kanawha, and to traffic between Zanesville and Pittsburg via Marietta and the Muskingum. Thus the channels of trade are diverted and shippers resort to the railroads, and the river shipping interests suffer thereby and it takes some time for the steamers to regain the confidence and patronage of shippers. Whereas if a 9-foot stage was assured at all times of the year the steamboat trade would become stable and reliable and, in my opinion, would in ten years double in volume and serve to develop all branches of trade in like proportion in the Ohio Valley.

I certainly believe that the above statement is true as to the whole Ohio River from Pittsburg to Cairo.

LETTER OF THE TELL CITY WOOLEN MILLS, OF TELL CITY, IND.

Replying to your letter of recent date will say I fully appreciate the importance of the "Ohio River Board" of Engineers as appointed by the Twenty-eighth Congress, relative to the improvement of the Ohio River, and I hope your association will be successful in showing and convincing this board of the great value an improved river will be to the commercial and manufacturing interests and the people in general.

The Ohio River the past season has been at a good stage, navigable almost the entire year, something unusual that does not happen very often, but this condition of the river had the effect of doubling our shipments by river, it had the effect to compel the railroad company to give our shippers more and better car service and lower rates, and now the 9-foot stage advocated and demanded by your association has more and better friends than ever, this fact was clearly demonstrated here in our locality a few weeks ago, when our present Congressman, in a primary election, went to his defeat by over 500, just because the people believed he had not done what he could have for the improvement of the Ohio River.

With one or two exceptions all of our manufacturers obtain their raw material by river. With the good stage of the river the past season they have been able to operate their plants the entire year, therefore an improved river, a 9-foot stage, uninterrupted navigation the year round, is of such great value to our city and locality in general that I hope and trust for a favorable report from the "Ohio River Board" to Congress and the ultimate realization of 9 feet from Pittsburg to Cairo.

LETTER OF THE POMEROY SALT ASSOCIATION COMPANY, OF POMEROY, OHIO.

We have given your Mr. Williams actual figures on the amount of salt moved by water from the Pomeroy Bend in 1905, and at his request we will now answer the last question on your form, which requests what would be the effect on our business if we had a permanent navigable stage of water in the Ohio River.

With the present uncertainty of river navigation on account of the long period of low water occurring at the season of the year when we could do the largest volume of business, we are not justified in providing the proper facilities for transportation of salt, and, therefore, when we have open navigation, can take advantage of only very limited facilities and of supplying such market as may be available at the time shipments are possible. With a 9-foot stage in the Ohio, interferred with only by ice, which can be expected during the

months of January and February, the dullest months in the year, we would be justified in providing barges and steamboats for special transportation of salt, and would be enabled to contract deliveries at the season of the year when the trade and consumer require it; would be enabled to make the freighting of our product a nominal and not the principal cost at the point of delivery, and would not hesitate to make the investment necessary in transportation facilities for fully four times the amount of salt transported in 1905, which would be, in round numbers, 100,000 tons.

LETTER OF A. WALLER & CO. (GRAIN), OF HENDERSON, KY.

Answering your inquiry as to what effect, we think, the permanent improvement of the Ohio River would mean to Henderson, will say that we can imagine nothing that would be more conducive to the upbuilding of this city and its surrounding country than the improvement contemplated by your association, resulting in a 9-foot stage of water the year round from Pittsburg to Cairo.

As conditions are now, on account of the uncertainty of navigation on the river, the business interests of this city depend in a very small degree upon transportation by river, and comparatively little tonnage is moved away from Henderson by water and only the agricultural products of the country within a small radius tributary to the river is transported to Henderson by water. Whereas if navigation could be depended upon the year round we dare say that probably 50 per cent of her business, to and from this city, would be moved by water.

Again Henderson is now suffering from a discrimination in freight rates to east, north, and west, as compared with Evansville, which we believe we could compel the railroad companies to remove if we had a stage of water on the Ohio River that could be depended upon the year round.

We wish your association all of the success which the merit of the enterprise deserves, and trust it will not be many years before our hopes are realized.

LETTER OF THE CHAIR MAKERS' UNION, OF TELL CITY, IND.

Being that Congress is still in session, we kindly urge you not to forget the appropriation to improve the Ohio River. We ask this because we are almost compelled to have the river navigable the year round, both for our incoming and outgoing freight. Last year the Ohio River was navigable the year round, which does, however, not occur once in twenty-five years; the result was that we did four times the amount of shipping we ever did. In fact we would have been compelled to shut down a good portion of the time on account of the shortage in cars if it was not for the good stage of water we had in the Ohio River last fall. By all means urge a 9-foot stage of water; this will allow larger boats to run, which would mean through boats from Cincinnati to New Orleans. A 6-foot stage will hardly allow large enough boats to run to make through trips paying, unless rates are made excessive. You understand that the larger the boat the more freight it can carry, therefore the cheaper or lower the rate. We are dependent on the river for our raw material, therefore very anxious, still all the factories in our city get most of their raw material by river, so they are all anxious to see a 9-foot stage of water. You can judge by the contribution you get each year from our city toward maintaining the association that we are a unit on a 9-foot stage. Right here, I want to say that our present Congressman, Mr. Zenor, is having the fight of his life to get a renomination from his party, only because he has not taken the proper interest in the improvement of the Ohio River. Tell City always stood by him firmly until several weeks ago at a primary it gave his opponent a majority of 222 out of a total vote of 386. We only give this illustration to show you how desperate the people are getting in securing Congressmen who have the interest of the country at heart.

With the 9-foot stage the year round on the Ohio and Mississippi rivers and the completion of the Panama Canal, this country will prosper as it never has before. The effects of improving the Ohio River will not only be local but national. Mr. Bettinger's address at Cairo ought to be read by every Congressman, because he makes points in it that are impossible for me to make.

LETTER OF THE SOUTHERN STOVE WORKS, OF EVANSVILLE, IND.

We are large shippers by water from Evansville, and it is a serious question with us very frequently to use that highway, because in low stage of water we are unable to ship goods by river, lose business thereby, as we are obliged to ship them all by rail at an increased freight rate, and our business has been seriously injured by the fact that during so many months of the year we are unable to avail ourselves of river shipments by reason of the low stage of water, and we earnestly beg you to do all you can to increase that stage of water by action of Congress.

LETTER OF THE STANDARD BRICK MANUFACTURING COMPANY, OF EVANSVILLE, IND.

We are very glad to see that prospects are becoming brighter for an improved river, and that we may be hopeful that the day is not far distant when the Government will recognize its importance to this district and will come to our rescue.

As to significance of this proposition as it relates to our industry, permit us to call your attention to the fact that the high freight rates on the railroads limit our selling territory to less than 100 miles, and wherever a point can be reached by river we can get a much lower transportation charge by water. Now it so happens that always when the building season is at its highest point the water in the river is at the lowest, and in fact during the summer months, the time when we have to depend upon placing our output, the river has been so low that it was unsafe to start off a barge load of brick and no boatman could be induced to undertake it.

Until such time as that a 9-foot stage is given us, we will be deprived of a lot of business and many people in the surrounding territory who have no railroad connections will be seriously handicapped in building operations during the best time of the year, or if they succeed in getting their material over the railroad are obliged to pay much higher trasportation charges.

LETTER OF THE I. GANS COMPANY (WHOLESALE DRY GOODS), OF EVANSVILLE, IND.

We write this letter to emphasize the great needs for navigable stage of the Ohio River such as the Ohio Valley Improvement Association is laboring so incessantly to accomplish. We, of course, write from our standpoint here in Evansville.

Every year navigation closes for several months, and many towns far away from railroads that run out of Evansville turn their trade away to other cities; in many instances some of our customers order by rail, the nearest station to them, but in every instance we have to divide the cost of freight; thus it is expensive to us, yet we are forced to do so to hold the trade.

Two years ago we made a shipment amounting to over $100; goods were put off at a certain landing, but on account of the low water the boat was naturally irregular in reaching said landing. In consequence our customer was not at the landing when boat reached there; however the goods were put off at our risk and were stolen.

If we had a good stage, boats could run regularly and there would be no risks to assume, because parties could be on hand at such landings to take charge of goods. We also find that our trade order all their goods by river, even where railroads touch those places, on account of the cheaper rates.

When the river gets real low, permitting only small crafts like gasoline boats to navigate, we frequently haul goods to the wharf, but have to haul it back again as the small boats can only carry so much. This improvement of our river does not mean a benefit to Evansville only, but the whole country is interested. Shipments from northern cities for points on Green River come to Evansville, but are delayed until sufficient water will permit larger boats to carry goods.

Locks and dams on Green River make that stream navigable at all times, yet two years ago we could not even ship to points on Green River, owing to the extreme low stage in front of Evansville. We consider that the improvement of our rivers is as important as the Panama Canal.

LETTER OF THE LAWRENCEBURG ROLLER MILLS COMPANY, OF LAWRENCEBURG, IND.

Referring to your letter of March 31st, the writer has not had time as yet to gather information of a general character bearing on the subject-matter of your letter. If it is your desire, however, that the outgoing and incoming tonnage of freight of this city be gathered together, we shall make an effort to do so through the machinery of our commercial organization.

Speaking for ourselves, we can say that a 9-foot stage all the year round would be a great benefit to us in many ways. Every year our trade is increasing at river points; we also get considerable of our raw materials from the river, and if we were guaranteed a shipping stage at all times of the year, great improvements would be made at the wharfs at the different points, so that shippers could use the river to better advantage than they can at the present time.

There are many things to be said in favor of river transportation. Perhaps one of the most important is that the time is shorter and we can usually calculate on freight arriving on time, whereas with the railroads it is very indefinite.

The city of Lawrenceburg was, as you perhaps know, at one time one of the largest shipping points along the river, and it would no doubt to-day regain a great deal of its lost prestige in that direction if the river was at a uniform shipping stage. There are a great many industries here; in fact the town itself is built up entirely by manufactures, and the number of these are increasing from year to year. We have just added within the past two or three weeks another large concern who were attracted here by the facilities that were offered by the river at this point, and we are quite certain they would be much benefited by a continuous shipping stage. There is not a concern here but uses the river to some extent all the year around when navigation is possible, and we are confident this business would be built up, and very materially, if we have uninterrupted transportation.

In regard to your second question as to the chief industries of the city, we will say that we have one of the largest tight cooperage works in the country, a very large pump concern, operated by A. D. Cook; the second largest distillery in the world; the largest flour mill in the State of Indiana. We have breweries, saw works, furniture factories, buggy factories, and several small concerns which are doing light manufacturing. The product of these various manufactories go to almost every part of the civilized globe, and they naturally use the river whenever they can do so.

The South, as everyone knows, is now coming to the front and is going to be one of the best customers we have. The cotton mills of the East are moving into the South, and conditions there have improved nearly 100 per cent over what they were a few years ago. There is plenty of money there, and business is being done there largely on sight-draft terms, which is an indication of a healthy state of affairs. The Ohio River should be the means of transporting a great deal of freight into that country, and we have no doubt that if the Government in their wisdom will see fit to give us a 9-foot stage the year around, they will be amply paid for any expense used in connection with this matter, and we feel certain that all the manufacturers who can use the river will do so in preference to any other means of transportation to river points.

If any special information should be required, kindly advise and the writer will endeavor to have the secretary of our Commercial Club gather and compile it in such a manner that it will be easily gotten at.

LETTER OF THE PORTSMOUTH STEEL COMPANY, OF PORTSMOUTH, OHIO.

Agreeable to conversation with your Mr. Williams to-day, we would advise that at the present time we are not shipping but very little, if any tonnage by river, partly for the reason that it is not navigable the year round, but principally for the reason that we have not a landing directly opposite our works; and as we are located about 4 miles from the local wharf boat, it would entail considerable expense in cartage for us to endeavor to ship a very large portion of our tonnage by river.

However, if the Ohio River was navigable the year round we would unquestionably arrange for wharfage facilities immediately opposite our works in which event we would doubtless be able to ship a very considerable tonnage by river.

We are producing annually about 100,000 gross tons of material, but just at the present writing could not give you a definite idea as to what proportion of this tonnage we would be able to ship by river, even though we had wharfage facilities, for the reason that it would depend altogether into what markets we sold our tonnage.

LETTER OF THE EAGLE COTTON MILLS COMPANY, OF MADISON, IND.

In compliance with the request of Mr. M. C. Garber of the Commercial Club, he desired me to write you as to the probable tonnage that would be shipped by water in case the river was brought to a navigable stage the year round, and in answer would say that the Eagle Cotton Mills Company use annually from 4,500 to 5,000 bales of cotton, and this would all come by river and at least half of our production would be reshipped by river, which would make in the neighborhood of, with raw material received and stock shipped out from the Eagle Cotton Mills Company, from 15,000 to 18,000 tons per year which would go by water.

Our production consists of brown sheetings, twine, wick, and carpet chain.

LETTER OF C. CRANE & CO. (LUMBER) OF CINCINNATI, OHIO.

Complying with your request we wish to submit the following facts. We bring from the mountains of West Virginia about 100,000,000 feet of logs and timber every year, which will weigh about 800,000,000 pounds or about 400,000 tons. We own two steamboats that do the towing, which keeps them busy, and we don't do much of anything else on the river, but from our thirty years' experience along the river, there is no question in our minds but what the people from the mouth of the Mississippi to points in Pennsylvania and New York, and for at least a distance of 200 miles on either side of the Ohio River, would receive untold benefits from a 9-foot stage that could be maintained the year round, and we believe that it would have a greater influence than anything else in regulating rates and keeping them within reasonable bounds. This would asio lead to a 9-foot stage from Cincinnati to Toledo, connecting the lakes and river, and would compel the railroads to carry freight at reasonable prices or not retail the business.

We are willing to cooperate in every way we can with your association and try to bring the matter in its proper light before the committees in Washington that have the matter in charge, and we can not but feel that when they are fully aware of the facts that they will consider this the best expenditure of public money that the Government could make.

LETTER OF THE PACIFIC COAL COMPANY, OF LOUISVILLE, KY.

It is with great pleasure that I acknowledge yours of the 14th inst., and in reply beg to state that our current year runs from November to November. From November 1904 to November 1905 we received 52,000 tons of freight via river. This company does not make shipments from Louisville.

In reference to the 9-foot stage, we desire to say that a peramnent stage of this depth would be of inestimable value to us, as our tonnage is frequently curtailed as a result of low water and the inability of boats coming from Pittsburg to carry tows. This necessitates a cessation of business, or else forces us to purchase from rail operators a supply sufficient to take care of our current trade. This, you realize, represents a large expense to us and consequent loss.

To overcome this difficulty it becomes necessary for all the coal dealers operating by water to arrange to operate yards, and carry a stock of several thousand bushels to provide against a low river, and to enable us to protect our trade. This condition and arrangement has always proven unsatisfactory, as the cost of yarding coal is considerable, and we are out as well the interest on our investment as the amount of slack that is made in yarding coal represents a great loss to us.

I feel that if Congress would awaken to the necessity of giving inland waterways sufficient consideration and appropriate a sum sufficient to make said waterways navigable at all seasons of the year, that the business of the river would be increased materially, and in consequence a saving be made as far as the dealers using the river as a means of transportation are concerned.

You will pardon this lengthy letter, but this company feels that the improvement of the Ohio River in this respect is of the utmost importance.

LETTER OF THE LOUISVILLE AND CINCINNATI PACKET COMPANY, OF LOUISVILLE, KY.

Complying with your favor of February 14, I submit the following tonnage on freight received and shipped by this company during the year 1905. For your information I will say that we were able to operate our boats only about nine and one-half months in the year 1905, and had we been able to operate entire year tonnage no doubt would have been much greater, and I feel that had we had a 9-foot stage in the Ohio River we would surely have operated entire year:

Tons received	62,204
Tons shipped	44,662
Total	106,866

In connection with the above will state that, in my opinion, if we had an uninterrupted 9-foot stage of river that tonnage by water in our immediate territory, between Louisville and Cincinnati, would be doubled annually. This would certainly prove very beneficial to our merchants and consumers, as a 9-foot stage would enable us to operate our steamers during the entire year and successfully compete with rail lines, thereby cheapening freight rates very considerably.

LETTER OF THE LOUISVILLE AND EVANSVILLE PACKET CO., OF LOUISVILLE, KY.

Your favor of the 14th ultimo to hand and noted. In reply to same I inclose you herewith a copy of the tonnage handled by this line between Louisville and Evansville for ten months ending December 31, 1905. This is a copy of the report which was forwarded from this office to Colonel Ruffner, of Cincinnati. As you will see by the report our business increased 41.15 per cent over 1904 freight carried by the packets and 57.14 per cent increase on towing over 1904. This was on account of having an excellent stage of water during the entire year, that is, from the first of March until December 31, 1905, the river being closed during January and February of 1905. The benefit this company would derive from an uninterrupted 9-foot stage of water in our river would be incalculable, as it would give us an opportunity to handle the vast amount of produce raised in our territory. It would benefit the apple growers very materially. Heretofore, when the apple crop was ripe and ready to move, it has always been our misfortune to have low water, and thus thousands of dollars worth of apples have perished on account of there being no boats running on the river to handle same. The tonnage in our territory is increasing every year on account of the territory becoming more thickly populated, and we deem it a necessity for our Government to take action relative to a 9-foot stage and secure same at the earliest possible time.

LETTER OF THE O'NEIL COAL AND COKE COMPANY, OF LOUISVILLE, KY.

In reply to your favor of the 14th inst., say, during year of 1905, we unloaded 8,602 tons of freight at our landings, consisting of nails, barb and fencing wire. Regarding receipts of coal and coke for same period, say, Mr. Chas. H. Bohmer, sales agent for Monongahela River Consolidated Coal and Coke Company, Second and Water streets, this city, has the tonnage record for same, covering all of Louisville, New Albany, and Jeffersonville, hence any statement we may report on this subject will conflict with the statistics you are about framing.

If you have not addressed a similar communication to him we suggest that it be done.

Benefits we would derive from an uninterrupted 9-foot river navigation are: Less investments, less space for storage (coal and coke), less general operating expense, all of which deducted from costs will be a saving to consumers in this vicinity.

LETTER OF B. F. AVERY & SONS (AGRICULTURAL IMPLEMENTS), OF LOUISVILLE, KY.

In reply to your circular letter of February 14, would say, during the fiscal year 1905, we received about 300 tons of freight by river, mainly steel and steel products from Pittsburg. We sent out about 35 tons, mainly our finished goods, to southern ports.

We favor the improvement of the Ohio River in every way possible, because the more said river is available for navigation the more railroads will be held down in their freight rates and impelled to give better service. Besides, it is a fact that there is always a congestion in the railroad yards about Pittsburg, and the railroad lines are entirely unable to give prompt service out of Pittsburg because of the excessive amount of business to be handled and their facilities being insufficient. It is therefore of great importance that the Ohio River be kept in navigable condition so as to aid in relieving the railroad congestion.

We would, no doubt, receive and ship considerably more by the Ohio River if it could be relied upon all the year round.

LETTER OF THE KOSMOS PORTLAND CEMENT COMPANY, OF LOUISVILLE, KY.

In the first place, we beg to say that we depend entirely upon the river for the limestone rock which we use in the manufacture of our cement. Our quarry is located in Kentucky, on the banks of the Ohio River, and we carry our stone from there by barge to our works at Kosmosdale, Ky., which are also on the river. On the average, we ship from two to three barge loads of 500 tons per week. During 1905 we shipped in this way about 75 barges of rock. However, we were in operation only about five months during 1905.

With the river as it is now, we are obliged, during the period of high water, to accumulate sufficient rock to carry us over the usual low-water season, and the benefit which we would derive from a 9-foot stage throughout the year is of the very greatest importance to us.

In addition to the rock which we ship from the quarry, we also receive by water all the machinery and repair parts for our plant at the quarry, and we are obliged to see far enough ahead, which is often difficult, in order to keep ourselves well stocked with the necessary things in order to prevent the interruption of our plant at such times when the river is not navigable.

The same thing may be said about our coal supply, which we get by barge from Pittsburg and which we are obliged to buy and store in sufficient quantities to carry us over the low-water stage. In 1905 we received about 6,500 tons of coal by river at our plant at Kosmosdale; this was during about five months of the year. Under ordinary running conditions we would bring in by river about 30,000 tons during the year.

During 1905 we did not ship out any cement by river, as we were not prepared to do so; but we contemplate using the river for shipping cement to river points in barge-load lots, and a 9-foot stage throughout the whole year would be of inestimable benefit to us and would enable us to use the river extensively for the transportation of our cement. With the river as it is now it will be very difficult to develop river transportation, as we could not keep our customers in line with the market prices if we shipped at one time by water (enabling us to give them a lower price) and at another time be forced to ship by rail, which would be more expensive.

If this does not give you all the information which you wish, kindly let us know and we shall be pleased to give you any information we can. We are deeply interested in the improvement of the river and sincerely hope that some action will be taken in this matter in the near future.

LETTER OF THE ANCHOR STOVE AND RANGE COMPANY, OF LOUISVILLE, KY.

Replying to your favor of the 14th, we have kept no accurate record of our receipts or shipments, and therefore are compelled to make an estimate, which we should say would be 100 tons in and 100 tons out. This amount bears no relation however to what it would be if we had an uninterrupted 9-foot stage of water, for the simple reason that we would then be able to get a great deal of pig iron and coke via the river, which we are now unable to do; it is too uncertain.

Years ago we used to buy many hundreds of tons of pig iron via river during the year, but the uncertainty of the river transportation has cut almost all of this out, and the same thing has happened to outgoing freight.

We believe it will be very hard to estimate the benefit, not only to manufacturers and merchants, but to all concerned, if the Government furnishes an uninterrupted 9-foot river navigation.

LETTER OF THE DOW WIRE AND IRON WORKS, OF LOUISVILLE, KY.

We are pleased to state that we are anxious to secure uninterrupted river navigation. We feel that it would be of great benefit to our firm, as our business up and down the river is growing. A great deal of it comes by railroad at a higher rate of freight than we would have to pay by boat, and if we could get this continued navigation, we could then know what to base our calculations on, so as to get a larger business than we now do from and to points reached by the river. The river not only gives us cheaper rates, but when the boats are running they are much more prompt and reliable in delivery. It sometimes requires a week to get goods by railroad from a point not more than 100 miles up the river, whereas by boat we can get it certainly in one day's time, so that we have two strong reasons for wanting continuous river navigation.

LETTER OF THE BELKNAP HARDWARE AND MANUFACTURING COMPANY, OF LOUISVILLE, KY.

In reply to your circular letter of May 2, beg to state that the benefit we would derive from an uninterrupted 9-foot river navigation in the Ohio would be very great, as we have in the course of our business large shipments coming to us from up river points. We think we could state the tonnage to our house alone is somewhere in the neighborhood of 25,000 tons annually, so it is quite an item to us to have a uniform stage of water, and we are heartily in favor of the proposed plans to secure it.

LETTER OF C. J. WALTON & SON (STEAM BOILERS), OF LOUISVILLE, KY.

Replying to your favor of February 14, the amount of freight we received and shipped by river is not large, and last year amounted to:

	Tons.
Freight received	23
Freight sent	23

We used to receive nearly all of our inbound freight from Pittsburg by river, but of late years, the mills have been shipping by rail, as we presume they find it more convenient having sidetracks running into their works, but the time in transit by rail is always much greater than by river. We do not think that we would ever have much outbound freight by river, owing to the fact that boilers are difficult to load and unload on a steamer.

The mere fact that it is possible to ship by river, however, seems to very greatly influence freight rates and it is quite probable that with an uninterrupted 9-foot river navigation would come additional facilities for handling bulky and heavy freight in which event our shipments would very largely increase by river.

LETTER OF JONES BROTHERS & CO. (CIDER AND VINEGAR), OF LOUISVILLE, KY.

Replying to your communication of February 14, beg to advise that we have gone into our records for the year 1905, and we figure that we have received and sent approximately the following amount of freight by river:

	Tons.
Received	25
Sent	100

We further estimate that an annual 9-foot river navigation would increase our river traffic to the following:

	Tons.
9-foot stage receive	100
9-foot stage send	500

Trusting that the recommendation of the Board will result in favorable action * * *

LETTER OF O'DONNELL & CO. (COAL), OF LOUISVILLE, KY.

We have carefully gone over our business and find we received by river 55,356 tons of coal during the year 1905. We ship no freight by river at all; as to the benefit we would derive from an uninterrupted 9-foot stage of the river, we figure it would reduce our operating expenses at least one-third, which would mean about $10,000 each year. For we would be able to handle our coal direct all year round; where now on account of low water we are compelled to store a great deal of our yearly output which necessitates the time and expense of rehandling it. We are greatly in favor of a 9-foot stage and will be glad to do what we can at any time to accomplish it.

LETTER OF HARBISON & GATHRIGHT (WHOLESALE SADDLERY), OF LOUISVILLE, KY.

Complying with the request embodied in your circular letter of the 14th instant, we give below as accurately as possible the information asked for.

We both receive and ship freight by river, and for the year 1905

	Tons.
We received by river	60
We sent by river	12

The benefits we would expect to receive from an uninterrupted 9-foot river navigation, are: First, a lower level and more uniform basis of freight rates; second, lower and more uniform prices on coal and other supplies for manufacturing purposes; third, avoiding the necessity for accumulation of overstock of commodities, such as coal, etc., and which we would have to lay up in quantities if we have to figure on a closed river on account of low water. Even now when the stage of water in the river is good the traffic is less than it would probably be the year round could the business world depend on regularity of boats as they can on railroad trains.

LETTER OF THE OHIO RIVER SAW MILL COMPANY, LOUISVILLE, KY.

Replying to your letter of May 2, will say that we should be benefited by a 9-foot river stage very greatly for the reason that this would afford us opportunity to deliver logs and timber to our mill for manufacturing purposes during the entire year, whereas the river frequently gets too low during the summer and fall seasons for us to do this, as the boats that handle this timber for us can not run for lack of water. Our timber is all delivered to us either floating or on barges and approximately the tonnage is 75,000 to 100,000 tons. This timber is manufactured here and is of great use to the citizens of the city for building purposes. Certain delivery of this timber which would be assured in case of a fixed stage of water, would be of very great benefit to the consumer as well as those in our line of business.

LETTER OF E. T. SLIDER (COAL, TOWING, DREDGING, WRECKING, ETC.), OF NEW ALBANY, IND.

Will say that I am situated at New Albany on the Ohio River and the amount of my business depends entirely on the stage of water we have in the Ohio River during the entire year, last year being the first year that we had sufficient water to work during the entire summer.

A 9-foot stage would not only benefit me in a great many ways, but it would make the price of coal much cheaper to the consumers of coal in New Albany, as we would not be compelled to go to the additional expense of storing coal in our yards in sufficient quantities to take care of our trade during the dry seasons and also lightening up barges when we run out of coal in order to get them through the canal and to our landing at New Albany. The stage of the river in the canal and also in the channel at New Albany gets as low as 30 inches during the extreme low water season of nearly every summer. I am unable to do very much business in either unloading coal or sand after the stage gets below 5 feet.

You can readily see that almost every year I am shut out from three to four months. During the year of 1905 I received approximately 63,000 tons of coal by barge from Pittsburg and the West Virginia coal fields. I also unloaded approximately 20,000 tons of Ohio River sand and about 3,500 tons of Ohio River gravel.

This was one of the largest years I ever had and was due entirely to having a good stage of water to do business on.

LETTER OF THE I. F. FORCE HANDLE COMPANY, OF NEW ALBANY, IND.

* * * with reference to a 9-foot stage in the Ohio River, also the amount of business which we have done during the year 1905. We have received less freight and shipped less in 1905 by the Ohio River than we have for several years previous. We received 959 tons of freight during 1905 and shipped out only 12 tons. The reason we did not ship out more is that our business is largely export and our trade is mostly north of the Mason and Dixon line. We will say this that a 9-foot stage in the Ohio River would be very beneficial to us and it would also be to the Roberts and Conner Veneer Works below us who have just started up. These people have located on the Ohio River as a resource for getting their supplies and also making what shipments they can. We export a great deal of our goods to Liverpool, London, Glasgow, Manchester and Bremen, Rotterdam and various other ports direct and a great many of these goods are being shipped to-day via New Orleans, but we are obliged to use all rail to that port on account of there being no line of steamers to ship by river. The uncertainty of the Ohio River has discontinued all lines from Cincinnati to New Orleans. By having a 9-foot stage of water we would know what to depend on just the same as we would by having a railroad and anyone who has done business to any extent knows that water is one of the greatest competitors against railways that we have in this or any other country.

In conclusion, we wish to say that we heartily indorse the Ohio River movement from the beginning to the end.

LETTER OF THE OHIO VALLEY TOWING COMPANY, OF NEW ALBANY, IND.

I beg to advise you that I have shipped and received about 40,000 tons of freight during the year 1905.

I am fully satisfied that my business on the Ohio River would fully amount to twice the above amount if I had an uninterrupted 9-foot stage of the river.

LETTER OF THE ANCHOR STOVE AND RANGE COMPANY, OF NEW ALBANY, IND.

Replying to question 3, no doubt if there were a regular stage of water in the river much of our pig iron would come from Ohio and West Virginia and our coke supply could also be drawn from Pennsylvania or West Virginia by

water instead of rail, and these two items of raw materials would approximate 3,000 tons. This could also be increased by such items as fire brick and coal.

In reply to question 4, we draw no supplies from abroad.

In reply to question 5, the effect could not but be exceedingly beneficial, as it would largely cheapen raw materials and would also cheapen the cost in distributing the finished products, and must result in a large expansion in the manufacturing industries, located on the river.

Replying to question 6, we have no accurate record and do not think that our receipts and shipments by river at the present time will exceed 500 tons and most of this is shipments of the finished product. On account of the uncertainty of the river we are at the present time drawing very few of our supplies from points located on the river.

We do not believe too much stress can be laid upon the importance of the 9-foot stage of water from Pittsburg to Cairo. It will develop the Ohio Valley as nothing else could.

LETTER OF C. JUTTE & CO. (COAL), OF JEFFERSONVILLE, IND.

Complying with your request of recent date, we herewith hand you amount of coal tonnage received and shipped from here:

	Tons.
Received	281,200
River freight shipped	136,000

Shipments were all made to points on Mississippi River, the difference of 145,200 tons was consumed locally at Jeffersonville, Louisville, and New Albany.

The benefit we would receive from a 9-foot stage in the Ohio River is incalculable, for if we had that stage all the year we could boat coal to market all the time and could market it at a much less price to consumer, as it would not necessitate the investment in floating craft and steamboats it does now to carry a stock of coal to last from one rise to another which you know is very uncertain. Also would reduce the risk of transportation to a minimum which is a very great item of expense now.

LETTER OF HOWARD'S SHIPYARD, OF JEFFERSONVILLE, IND.

Yours of the 14th at hand in regard to a 9-foot stage in the Ohio River. It would be of great benefit to us. At present we are compelled to buy when we have water, in order to tide us over the low-water season. Our contracts often specify that we make delivery at certain points. We have to regulate everything to suit the stage of river, which is always an uncertain quantity. Repair work coming to us is always affected by the same cause.

We could not begin to estimate the benefit to be derived from a 9-foot stage to all our plants and certainly hope for a successful outcome of the movement.

LETTER OF THE CINCINNATI (OHIO) INDUSTRIAL BUREAU.

In line with our recent conversation regarding certain facts which have come to our attention during our past six years' work in behalf of the industrial interests of Cincinnati, and their bearing upon the river transportation question, I beg to submit the following:

The report issued by the Director of the Census on the tabulation of statistics for the manufacturing industries of Cincinnati for the calendar year, 1904, forming a part of the census of manufacturers of 1905, shows a total of 2,171 manufacturing establishments within the corporate limits of Cincinnati that have a product of $500 or over. These have a combined capital of $130,271,811 and a combined product of $166,059,050.

The Director of Census, in his explanatory references to the returns of Cincinnati, is very explicit in his statement that this number 2,171 is limited to strictly manufacturing institutions, and does not include any of the hand trades, such as dressmakng, custom millinery, cobbling, blacksmithing and the building trades.

The Director further states that though the number of industries is slightly less than that shown in the 1900 census, there has been a substantial increase in the manufactures of the city, pointing out that there has been an increase of more than 25 per cent in the capital employed; nearly 83 per cent in the number of salaried people, and more than 17 per cent in the volume of products.

These 2,171 establishments expended for material used in manufacturing in 1904, $83,258,492, an increase of nearly 17 per cent over the amount expended for the same purpose by manufacturers in 1900.

Some of the prominent industries in Cincinnati are boots and shoes, pianos, vehicles, machinery, furniture, soap, foundries, harness and saddlery and many others requiring lumber and iron as raw materials and using large quantities of coal as fuel.

At the present time Cincinnati's fuel supply comes largely from the valleys of the Kanawha and Monongahela rivers and is towed to Cincinnati by means of barges and tow boats. The uncertainty of navigation on the Ohio River has made the supply of coal brought from these valleys by tow boats sufficiently irregular to induce the carrying of coal in vast quantities by some of the railroad companies entering Cincinnati.

Coal dealers and large consumers of coal have been compelled by the uncertain moods of the Ohio River to witness millions of tons of coal held in the improved Kanawha and Monongahela rivers awaiting a suitable stage in the Ohio River to permit their being brought to this market.

A permanent boating stage in the Ohio River would guarantee to the manufacturers of Cincinnati and the Cincinnati district, cheaper fuel, more uniform prices, and the absolute certainty of a steady and abundant supply.

As already indicated, Cincinnati industries consume vast quantities of iron and steel, much of which could with a permanent navigation in the Ohio River be brought to the door of the manufacturer much more economically and we believe much more quickly than the railroads with their overabundance of traffic are able to do.

Much iron is brought to Cincinnati from the southern fields for distribution to various sections of the country and notably for industries that line the Ohio and Mississippi rivers. The ability to transfer this iron from car to barge at all times of the year for distribution by river would be of incalculable benefit to the consumers of this iron and also to the producers in the southern fields.

Cincinnati is recognized as one of the leading lumber markets of the United States and is especially a distributor of southern woods. With the exception of that which is brought in rafts from the Big Sandy and Guyan rivers, this lumber is brought to the Cincinnati market either by rail from eastern Kentucky and Tennessee or by barge from the Mississippi Valley. Arrivals by barge are infrequent, because of the uncertainty of navigation in the Ohio at present.

Considerable quantities of mahogany and other hard woods are brought to Cincinnati from Cuba and Central and South America, both for extensive use in local wood working industries and for distribution to other sections. At present this lumber comes by rail from Gulf ports as a rule. With a permanently navigable river the cost of bringing this lumber to Cincinnati could be greatly reduced to the great benefit of the consumer.

With the completion of the Panama Canal, Cincinnati manufacturers would be assured, with the Ohio permanently improved, of all water transportation for hard wood lumbers and other products of the extreme East and for hides and other articles from South America.

There are other raw materials reaching Cincinnati manufacturers from sections of the South tributary to the lower Mississippi, which would add to the volume of shipments that would reach this city from the South by water, were the Ohio River so improved as to make navigation possible at all times of the year.

If the industries of what is commonly known as the Cincinnati district are taken into consideration, the volume of shipments of raw material which could be brought into Cincinnati by barge and boat on a 9-foot stream of water could be multiplied at least by two.

The most careful estimate of the number of manufacturing plants in what is known as the Cincinnati district, and which embraces the outlying suburbs, including those across the Ohio River in Kentucky, is 8,000, and the estimated product of these factories for 1904 was $350,000,000. These figures are not regarded in the least exhorbitant by those who are at all familiar with the volume of manufacturing in the district referred to.

As you are aware we have in the work of the Industrial Bureau given this question of the benefit of the Ohio River to manufacturers very careful thought and attention, and while more definite figures than those given are difficult to obtain, we feel certain they are entirely within the points of accuracy.

LETTER OF FULTON, CONWAY & CO. (IRON, STEEL, HEAVY HARDWARE), OF LOUISVILLE, KY.

Answering yours of February 14, will say that the tonnage we now receive over the Ohio River is very much smaller than it was several years ago. Prior to the formation of the United States Steel Company our tonnage by the Ohio River was very large in proportion to the amount of business we did. We were getting then from 350 to 500 tons of freight over the Ohio River. Now this tonnage is nearly altogether by rail, as the United States Steel Company delivers its goods to us, freight prepaid, and as the river is such an uncertain quantity these goods always come by rail. Our tonnage that we receive over the Ohio River would not amount to over 50 tons per year and probably half as much shipped. We believe that a 9-foot stage of the river the year round would be of immense value to us as well as to all others in the wholesale business in Louisville. It would be hard to calculate just how much value we would receive, as the value would not be measured by the amount received and shipped by river, but would be largely increased by the reduced freight rates that we would be thus enabled to get from the railroads.

We earnestly hope that Congress can be prevailed upon to take steps to bring about this desired result.

APPENDIX IV.

NUMBER 1.

STATEMENT OF DREDGING ON THE OHIO RIVER BETWEEN EVANSVILLE AND CAIRO SINCE 1876.

[Prepared by Mr. E. J. Carpenter, assistant engineer, under the direction of Lieut. Col. William T. Rossell, Corps of Engineers, U. S. Army.]

Evansville, Ind., 783 miles below Pittsburg. The dredging plant hired from H. S. Brown dredged at the city wharf an area 160 by 1,200 feet, 6 feet below low water.

Excavation: July 19 to September 25, 1900—mud, gravel, and sand, 21,695 cubic yards.

The United States dredge made 2 cuts at the city wharf, one cut being 35 by 595 feet, and the other 35 by 305 feet, both cuts being 6 feet below low water.

Excavation: July 25 to August 5, 1901—mud, gravel, and sand, 7,360 cubic yards.

No complaint of filling up at this place has been received, although additional work has since been requested.

Center rock, below Uniontown, Ky., 834.5 miles below Pittsburg. This rock lay directly in the channel and consisted of hardpan on surface and hardened clay or soft rock below. It was reduced 1 foot by blasting in 1879, and was entirely removed to 5 feet below low water by the United States dredges.

Excavation: October 30 to November 4, 1884, 1,760 cubic yards.

No knowledge of any complaint since.

Tradewater bar, below Caseyville, Ky., 861 miles below Pittsburg. The shore bar above the mouth of Tradewater River was dredged as follows:

	Cubic yards.
Hired plant, May 17 to December 28, 1895—sand and gravel	62,560
Hired plant, October 16 to November 15, 1899	10,115
United States plant, September 20 to 26, 1899	8,319
	80,994

This work was done with the object of opening a channel along the Kentucky shore, between the towhead and the Kentucky shore below the mouth of Trade-

water River. It covered an area approximately 100 feet by 2,700 feet, 4 feet below low water, and though it soon filled with sand and gravel to a great extent, it made the back channel available at times when the outer channel was stopped by sand deposits.

Tradewater bar.—Dredging to open channel through sand bar from Kentucky shore to middle of river above Tradewater towhead, by United States plant:

Excavation: September 13 to October 8, 1892, soft sand, 24,230 cubic yards.

This cut was made 75 feet to 100 feet wide and 1,200 feet long with a depth of 5 feet below low water and lasted until the first rise of river, giving temporary relief to navigation.

Excavation: United States plant, August 8 to 11, 1901, soft sand, 6,150 cubic yards.

This cut, similar to last above, was made in approximately the same location, it was 35 feet wide by 1,225 feet long, 4 to 6 feet below low water; but it filled up quickly, and was of but little benefit to navigation.

Carrsville, Ky., 881.2 miles below Pittsburg. October and November, 1880, a hired plant removed 180 tons of large rocks.

Excavation: November 10, 1884, the United States dredges removed 2 rocks, 6.8 tons.

Golconda, Ill., 800 miles below Pittsburg, Pa. Dredging by hired plants:

Shore bar at and below wharf; area 60 feet by 1,350 feet, and adjoining section 30 feet by 800 feet, 7 feet below low water.

Excavation: July 27 to September 10, 1897, mud, gravel, and loose rock, 16,930 cubic yards.

Shore bar; area 90 by 1,180 feet, 6 feet below low water.

Excavation: November 17 to December 22, 1899, gravel, sand, etc., 9,980 cubic yards; logs and snags, 45.6 tons.

Dredging by United States plant: Shore bar at wharf, area 70 by 1,250 feet, 6 feet below low water.

Excavation: September 23 to October 10, 1901, 7,490 cubic yards.

The point of the rocky bar above Lusk Creek was also dredged off, widening the channel 140 feet for a length of 600 feet, 6.5 feet below low water.

There has been no complaint of filling up at either place, but requests have been made for additional work to further straighten the channel by removing more of the rocky bar above the creek.

Sisters, 897 miles below Pittsburg. End of old dike, built in 1832(?), projecting upstream into the channel was removed by United States dredges (about 100 linear feet).

Excavation: October 10 to 12, 1892, loose rock and gravel, 1,341 cubic yards.

Pilots have asked for additional work to remove dike.

Cumberland Island, 903 miles below Pittsburg. Dam from foot of Dog Island to head of Cumberland Island, begun in 1832 and completed in 1872–1874. A channel 420 feet wide was cut through the dam by United States dredges, November 3 to 27, 1876.

Excavation: Loose rock, 11,788 cubic yards.

This channel was widened to 720 feet by United States plant and deepened October 25 to December 1, 1877, 5 feet below low water.

Excavation: 16,488 cubic yards.

No trouble is experienced in getting through the dam at any stage, but the bar on right at foot of Cumberland Island sometimes fills with sand, obliging boats to take the channel to left of the island, which is sometimes blocked by a sand bar at the head.

Paducah, Ky., 920 miles below Pittsburg. At the upper crossing between Paducah, Ky., and Owens Landing, Ill., a channel was cut by a hired plant through the sandbar 70 feet by 400 feet, and at the lower crossing 70 feet by 650 feet, the amount of excavation being, October 5 to 14, 1897, soft sand, 4,040 cubic yards.

This work gave temporary relief lasting until the river rose and filled it up.

The plant also removed the old waterworks crib, outside of the foot of Tennessee Island, and 1 steamboat wreck and 10 piles of the railroad incline.

Excavation, September 16 to 27, 1899, gravel and sand, 1,450 cubic yards; December 2 to 16, 1899, sand, 1,840 cubic yards.

Brooklyn, Ill., 923 miles below Pittsburg. The improvement at this place was first the removal of "Brooklyn Rock," a formation of pudding stone about 100 feet by 200 feet at low water, lying on left of the channel about 250 feet from the shore line. After this had been taken out, a reef of the same material

extending diagonally downstream to the Illinois shore was removed, and later a considerable portion of the shore bar at and below the landing; the material at all these points being principally cemented gravel so hard that it could not be dredged until after it had been broken by blasting. Several wrecks and many logs, etc., were found on rock and on the bars. A deposit of mud, gravel, and logs was also dredged out at the upper end of the landing, below the railroad incline.

The work done by the Government dredges and hired plants working under various allotments from the appropriation for improving the river, extended over a number of years. So far as is known the improvement has been permanent.

The work done was as follows:

	Cubic yards mud, loose gravel, etc.	Cubic yards cemented gravel.
United States plant: Nov. 28 to Dec. 17, 1884		7,620
Contract: $1.10 per ton, 5,988 tons		3,959
United States plant: October to Dec. 17, 1892	5,286	34,050
Hired plant: Sept. 12, 1897, to Jan. 13, 1898		19,695
United States plant: Nov. 2 to 9, and Nov. 26 to Dec. 26, 1898	7,211	8,870
Hired plant: December, 1899		570
United States plant: Oct. 12 to Nov. 23, 1900	8,368	17,422

Little Chain, 934.5 miles below Pittsburg. "Upper center rock" was removed by hired plant to 8 feet below low water between September 25 and November 2, 1880.

At the lower end of the chain a group of rocks on the Illinois side of the chain was removed and some outlying rocks of the point projecting from the shore November 2 to 11, 1880.

Hillermans Landing, 939 miles below Pittsburg. The United States Plant removed on October 11, 1900, rocks weighing 19 tons.

Sharps bar, head of Grand Chain, 943 miles below Pittsburg. One cut, 30 feet by 1,613 feet, 6 feet below low water, was made by hired plant through a sand reef which has given much trouble, and the material thrown into bank.

Excavation: September 1 to 17, 1899, sand, 4,310 cubic yards. This channel lasted but a couple of weeks filling up again with sand.

Grand chain, 944 miles below Pittsburg. Work by hired plants: Jackson Rock, top cut down to 3 feet below low water by blasting, November 8 to December 8, 1876, rock removed 54 cubic yards. Arkansas Rock, August 13 to November 30, 1898, 310 cubic yards. October 19 to 25, 1879: 10-inch depth removed from top of Jackson Rock; 10 rocks removed near Grenadier Rock, 20 tons; 2 rocks near Arkansas Rock blasted and scattered into deep water: 4 high rocks near foot of chain removed by blasting.

November 12 to December 3, 1880, from Grenadier Rock, 150 cubic yards.

July 20 to November 4, 1881, near head of chain, 425 cubic yards.

1882, near upper dike, 300 cubic yards.

A hired plant removed the following:

November 13 to 24, 1899, remains of the *Richmond* wreck, part of a coal flat, and gravel and sand, 1,030 cubic yards.

November 24 to 25, stone pile near No. 2 dike, 175 cubic yards.

November 27 to 30, stone boat near No. 1 dike and loose stone, 120 cubic yards; sand, 555 cubic yards.

The United States plant removed the point of the limestone ledge at Jackson Rock, which had been blasted in previous years.

Excavation: November 25, 1884, loose rock, 718 cubic yards.

The removal of these rocks, besides eliminating dangerous obstructions to navigation, increased the depths of the channel, by permitting scour after the construction of the dikes contracted the waterway, and resulted in a very decided improvement. The river bottom throughout most of the Grand Chain is rocky, overlaid with gravel and sand, except where the current is so directed as to carry it away.

Mound City, Ill., 959 miles below Pittsburg.

	Cubic yards gravel, sand, etc.	Cubic yards cemented gravel.
Hired plant, Sept. 26 to Dec. 18, 1894	27,258	4,510
United States plant:		
Sept. 19 to Oct. 2 and Nov. 10 to 12, 1898	36,375	12,423
Oct. 2 to Dec. 14, 1899	33,383	30,966
Hired plant, Sept. 29 to Nov. 11, 1899	16,340	----------
United States plant:		
Aug. 21 to Oct. 6, 1900	23,193	5,258
Oct. 14 to Dec. 14, 1901	26,022	22,169
	162,571	75,326

The object of the dredging was to open a direct channel from the middle of the river opposite the towhead to the Illinois shore at Mound City, and thus to avoid the very crooked, narrow, and dangerous channel among the rocks along the Kentucky shore.

The lower end of the old channel had been closed by a dike built out from the Kentucky shore in 1893–94, and the dredging was for the purpose of removing the obstructing bar of gravel and cemented gravel lying in line of the new channel. The cemented portion of the bar was so hard that a great portion of it could be dredged only after the surface had been broken by blasting. This necessitated first the removal of the overlying softer material by the dredges, then blasting with dynamite, and then removal of the broken material, and owing to the refractory nature of the bar it was in some places necessary to blast and scrape off the bar two or three times before reaching grade—6 feet below low water. Owing to the location only 6 miles above the mouth of the Ohio the bar was often submerged by high stages of the Mississippi River, even when the Ohio was low, making it possible to dredge only at irregular intervals, with resulting loss of time and slow progress.

Most of the dredging was devoted to cutting through the cemented gravel bar, where for a distance of about 1,200 feet a channel was made to 6 feet below low water, 260 feet wide, with an additional width of 30 feet for all but 100 feet of this length.

The area dredged has a total length of about 5,000 feet, and the low-water channel has been established on this line. The channel fills with light sand during high water, but has so far as reported always cut out during the lower stages of river, and there appears to be no doubt that after completion of the dikes now under contract the river current will keep the new channel clear.

Dredging for the purpose of affording temporary relief to low-water navigation.—During the low-water season of 1899 the hired plant belonging to Wm. A. Kirk was sent over the lower river to cut channels through the obstructing bars, which usually consisted of light sand and thus afford temporary relief to navigation.

Shallow cuts, generally 3 feet below low water, were made through the crests of the bars, on the line of the low-water channel, and the material was usually thrown into bank on one side in such manner as to direct the current through the cut.

Officers of the small packets able to run on the low stage of river reported that the improvement was of considerable benefit, and that although most of the cuts were nearly filled up by the first rise, some of them afforded relief even during the following season.

The points thus improved below Evansville, Ind., were as follows:

Henderson Bend, 799.5 miles below Pittsburg. One cut 35 by 1,100 feet, 3 feet below low water was made in sand reef through crossing to Indiana shore and the dredged material banked on left of channel.

Excavation: September 28 to October 3, 1899, 3,125 cubic yards.

Mississippi Bend, 827.5 miles below Pittsburg. One cut, 35 by 480 feet, 3 feet below low water, was made through sand reef at upper end of bend, the dredged material consisting of soft sand, being thrown into bank on left of channel.

Excavation: October 3 to 6, 1899, 960 cubic yards.

Raleigh bar, 843.5 miles below Pittsburg. One cut, 35 by 950 feet, 3 feet below low water, was made through soft sand; the dredged material being thrown into bank in crossing to Kentucky shore at foot.

Excavation: October 6 to 8, 1899, 2,560 cubic yards.

Shawneetown bar, 845.5 miles below Pittsburg. One cut, 35 feet wide by 1,080 feet, 3 feet below low water was made through the sand reef in the crossing to the Illinois shore; the dredged material being thrown into bank on left of the channel.

Excavation: October 8 to 11, 1899, 2,240 cubic yards.

Greens bar, 853 and 854.5 miles below Pittsburg. One cut, 35 by 400 feet was made at the upper crossing and another cut 35 by 650 feet was made at the lower crossing, both cuts being 3 feet below low water; the dredged material in both cases being banked on the downstream side of the channel.

Excavation: October 12 to 14, 1899, 2,480 cubic yards.

Weston, Ky., 864 miles below Pittsburg. A cut, 30 feet by 200 feet, was made through the bar at the landing.

Excavation: November 15 to 16, 1899, mud and loose rock, 240 cubic yards.

The United States plant removed the remainder of the bar opposite the landing, and also dredged a channel through the bar along the Kentucky shore, 70 feet to 150 feet wide and 2,500 feet along, 5 feet below low water.

Excavation: August 21 to September 21, 1901—

Mud and loose rock	cubic yards	7,210
Gravel, etc	do	28,124
Loose rock	do	2,070
Logs and snags	tons	42.4

NUMBER 2.

BARS IN THE OHIO RIVER BELOW MOUTH OF GREEN RIVER.

[Prepared by Mr. R. R. Jones, assistant engineer, under the direction of Lieut.-Col. William T. Rossell, Corps of Engineers, U. S. Army.]

List of localities.

1. Green River Towhead.
2. Evansville, Ind.
3. Henderson Island.
4. Straight Island.
5. Slim Island.
6. Upper Highland rocks.
7. Lower Highland rocks.
8. Wabash Island.
9. Raleigh bar.
10. Browns Island.
11. Bar above Shawneetown, Ill.
12. Rock Bar at Shawneetown, Ill.
13. Bowlesville bar.
14. Upper crossing, Cincinnati bar.
15. Lower crossing, Cincinnati bar.
16. Caseyville, Tradewater, etc.
17. Walkers bar.
18. Hurricane Island.
19. Pryors Island.
20. Sisters Islands.
21. Cowpers bar.
22. Dog Island.
23. Cumberland Island.
24. Cottonwood bar.
25. Tennessee Island.
26. Little Chain.
27. Hillermans.
28. Grand Chain.
29. Mound City.

The channels past a number of islands have not been described because they are usually good or at least much better than those included in the first list. Among the localities those purposely omitted are:

1. Green River Island.
2. Dutch Bend.
3. Henderson Towhead.
4. Cypress Bend.
5. Diamond Island.
6. Walnut Bend.
7. Mississippi bar.
8. Saline bar.
9. Cave in Rock Island.
10. Irish Jimmys bar.
11. Grand Pierre bar.
12. Randolph Island.
13. Stewarts Island.
14. Indiana bar.
15. Bar below Paducah.
16. Belgrade bar.

CHARACTER OF BARS.

Green River Towhead, 777 miles below Pittsburg. A flat ledge of slate rock is said to extend from towhead to the Kentucky shore. The channel, which is narrow, but ordinarily of sufficient depth, follows along the Kentucky shore. While the ledge referred to does not at present interfere with navigation, it

may have to be reckoned with in connection with improvement of channel lower down, i. e., near Evansville.

Near Evansville, Ind., 781–783 miles below Pittsburg. The bar at this point is composed mostly of shifting sand. During the thirty years preceding 1872 the bar had moved downstream a considerable distance and assumed a position which threatened the existence of the public landing at Evansville. To prevent further encroachment and to cut off a portion of the bar nearest the city the construction of a training dike was begun in the season of 1872 and extended in that year from the Kentucky shore for a distance of 400 feet. This work was completed in 1879, with a total length of 2,600 feet. The training dike already alluded to had the effect of improving the channel opposite thereto, but did not greatly benefit the public landing, as the water fell away toward the Kentucky shore as soon as the end of the dike had been passed. To remedy this condition a spur dike was proposed (1892) at a point opposite the public landing at Evansville, to project about 1,200 feet from the Kentucky shore and thereby reduce the low-water width of the river to about 950 feet. The plan for improvement just alluded to was modified in 1895 so as to include six spur dikes. A project for these dikes was approved in August, 1896, and contract for their construction was approved January 9, 1897. The dikes vary in length from 180 to 1,500 feet and are carried up to a height of 4 feet above low water; five project from the Kentucky shore and one from the Indiana shore. This work was completed about September 15, 1897, and has resulted in a substantial improvement in the condition of the channel opposite the public landing at Evansville; complaint has been made that navigation at the upper end of the channel affected by the dikes is sometimes obstructed by shifting sand and gravel. The project of Lieut. Col. Amos Stickney contemplated a certain amount of dredging in the channel affected by the dikes just alluded to; no dredging, however, has yet been done.

Henderson Island, 798 miles below Pittsburg. The earliest records accessible (1808–1817) call this island "Red Bank Island No. 77," and describe the channel as keeping close to the island in order to avoid a sandbar on the right (Indiana) shore of the river. The map of reconnaissance by Captain Young and Captain Poussin and Lieutenant Tuttle (1821) shows a depth of 2½ feet near the lower end of channel lying between the island and high sandbar on Indiana shore. The report of Maj. S. H. Long (1826) is printed as House Document 145 in State Papers, Nineteenth Congress, first session. There are elaborate marginal notes on drawings forwarded by him to the Department at Washington. There are 6 sheets of such drawings or sketches, 5 of which describe the condition of the river and progress of the work, the sixth drawing being a reference sheet with magnetic bearings to various points on the island, the sandbars, and the proposed dike. "Sketch No. 1" bears the legend, "A sketch of the river exhibiting the form and condition of the sandbar just below Henderson at the commencement of the work in 1824." These maps are valuable as containing the earliest official reports of results in connection with the improvement of the Ohio River. Major Long's report indicates a depth of about 18 inches at a stage approximating low water. The dike constructed by Major Long extended obliquely downstream from a dry bar lying along the Indiana shore, but did not connect directly with the shore proper. The work above described effected, as believed by Major Long, some improvement in the channel opposite Henderson Island, but a survey made in 1872 disclosed the fact that there was still but 2 feet least depth in the channel opposite the island. A project submitted by Colonel Merrill, April 19, 1873, contemplated the repair and lengthening of the dike built by Major Long in 1825. During the progress of this work it became evident that it would be necessary to close the back channel between Henderson Island and the Kentucky shore; both dike and dam were ultimately completed, the former in 1875 with a total length of 1,900 feet, and the latter in 1874 with a length of 620 feet. Piles, brush, and stone were used in their construction. The channel opposite the dike had deepened to 4 feet (minimum) by 1876, but a bar had already begun to form below the foot of the island. A curious change in river bed resulting from this improvement was the gravel which had been carried over the top of the dike and deposited below the dike in places where deep water existed prior to the beginning of the work. A survey made in 1884 showed a minimum depth of 2 feet opposite the island. A survey made in 1902 showed 1.6 feet opposite the island and 1.5 feet at a point 1 mile below foot of island. These surveys show a gravel bottom along the Indiana shore above the island, a gravel bar at head of island, and a sand bottom in channel extending past the island to a

point 1 mile below. It will be noted that the records of channel at Henderson Island extend over a period of more than eighty years and that no material increase of depth has been gained during that time. The records go to show that the surface character of the bar or bars at Henderson Island has not greatly changed since the earliest surveys and that the bars are composed of shifting sand and gravel.

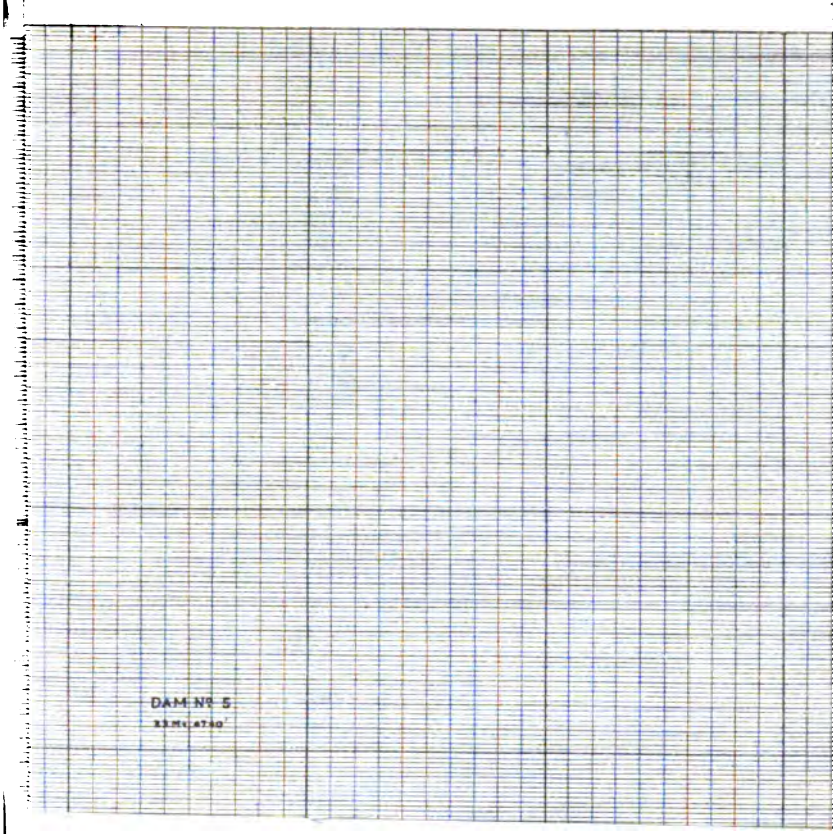
Straight Island, 816.5 miles below Pittsburg. The channel past this island had a minimum depth of 2½ feet in 1821, as shown on the map made in that year. No records subsequent to 1821 can be found in the United States engineer office at Cincinnati, Ohio, except the maps of the Roberts survey, which give a minimum depth of 2 feet 9 inches. There is nothing to indicate the precise nature of the channel bottom, but in the absence of any information to the contrary it may be assumed that the bars at Straight Island are composed of sand with perhaps some fine gravel at low stages of the river.

Slim Island, 820.5 miles below Pittsburg. This island is merely noted by Cramer (1808–1817), and by Roberts in his report (1867) is alluded to in connection with ledges of rock which make out from the Indiana shore, beginning at a point 2 miles above and extending to the island. The maps of the Roberts survey give minimum depth at Slim Island as follows: At head of island 3 feet and 3 inches, at foot 3 feet. The records of the United States engineer office at Cincinnati also contain surveys of Slim Island made in 1884 and 1904. Both show a minimum depth of more than 6 feet, but the channel where such depth is found is in places very narrow. In the present state of low-water navigation on the lower Ohio the channel at and above Slim Island is much better than at many other points, but as remarked in a similar case in connection with Green River Towhead, the presence of the rocky formation above the island may be felt in the event that the river channel at other near localities is deepened or otherwise changed. The surface indications of river bed past Slim Island are gravel at head of island and sand near the foot. The channel at foot is crooked, but not often very troublesome.

Upper Highland (or Louisiana) rocks, 831 miles below Pittsburg. The earlier river guides mention these rocks in connection with Willow Island as follows: "And as you turn the left-hand point of the Mississippi Bend, a ledge of rocks appears near the right shore, from which there is no danger by keeping near the left shore and pretty close round the point." The reconnoissance of 1821 indicates what may have been intended for the Upper Highland rocks, but does not mention them by name. The Western Pilot describes the rocks as extending out from the right shore as well as another reef on the left, to be later described. The Roberts survey shows the reef extending from the Indiana shore for about two-fifths of the width of the river. There is, however, a good depth of water, viz, 10 to 16 feet. There is nothing to show whether or not the rocky reef extends in a submerged condition across the channel. It should, however, be considered in connection with any project for improvement.

Lower Highland rocks, 834 miles below Pittsburg. The earliest records accessible mention the rocks in connection with Willow Island, and state that they "are not seen except in very low water, when the channel is near the right shore." The bar is shown on the map of reconnoissance made in 1821 with a depth in channel of 3 feet. The river guide of 1849 also describes the reef, stating that it extends to the middle of the river; in this it agrees with the reconnoissance already noted. Mr. Milnor Roberts notes the rocks in both report and map of his survey, stating in the former that the channel at foot of bar is changeable. The map of Roberts survey shows a depth of about 14½ feet, with a velocity of 5.7 feet per second. The remarks made in connection with the upper rocks as to character of river bed and possible bearing on future improvements apply equally to this lower reef.

Wabash Island, 838 miles below Pittsburg. The earlier records merely describe the channel as lying on the right and mention no special difficulties for the navigator. No soundings are given on the map of the reconnaissance of 1821 and there is nothing to indicate any special difficulty in the channel at that time. In a report made by Capt. R. E. Lee, to Col. Joseph G. Totten, Chief Engineer, dated November 20, 1839, after reciting certain localities on the lower Ohio where improvements had been made, continues: "There are other points on the river that much need improvements, among the worst of which are Flint Island bar, Wabash Island bar, Albany bar, etc. The completion of the system that has been adopted and the removal of the logs, etc., from the bed of the river, would insure to the navigation of the Ohio a depth of 3½ feet at low water." The Western Pilot of 1849 describes no difficult places in the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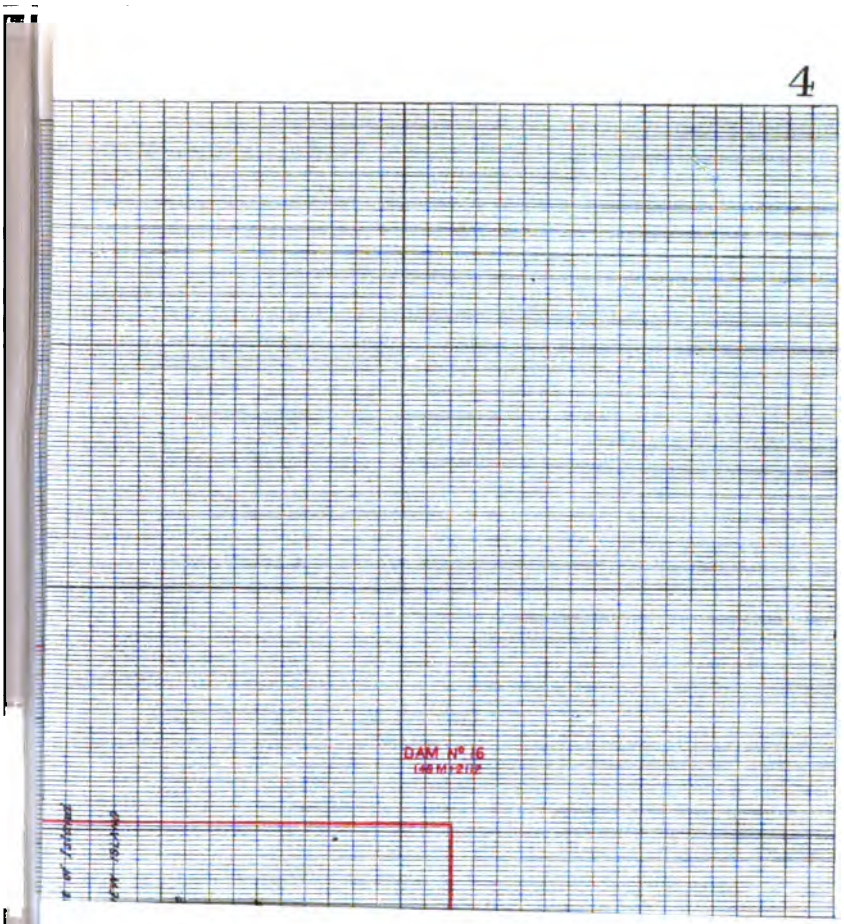
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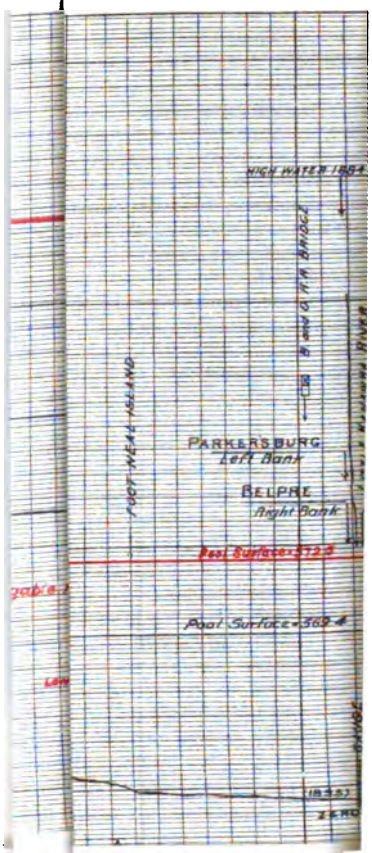
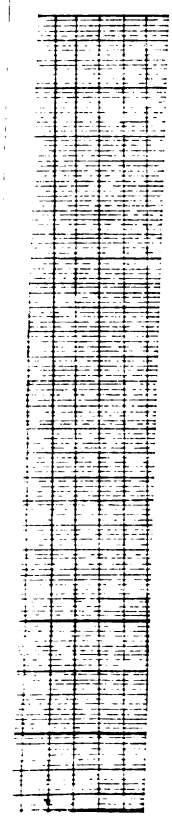
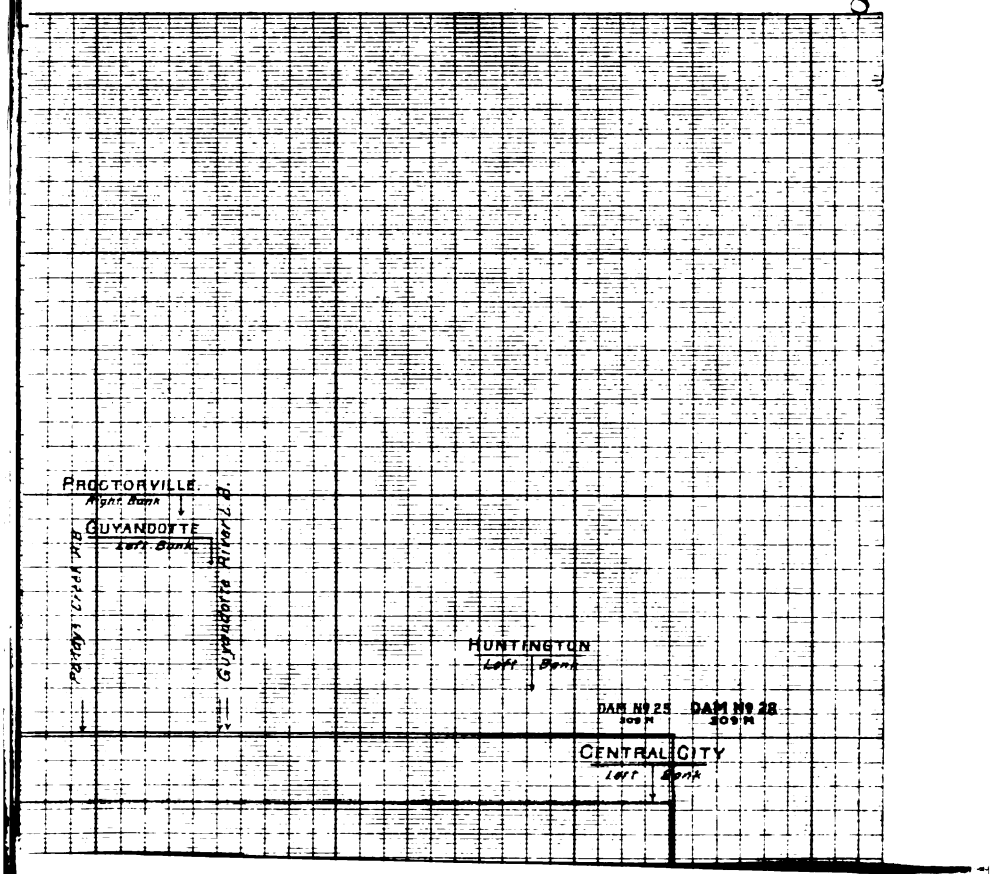
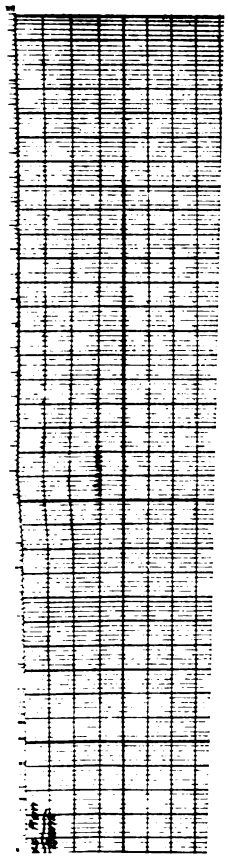
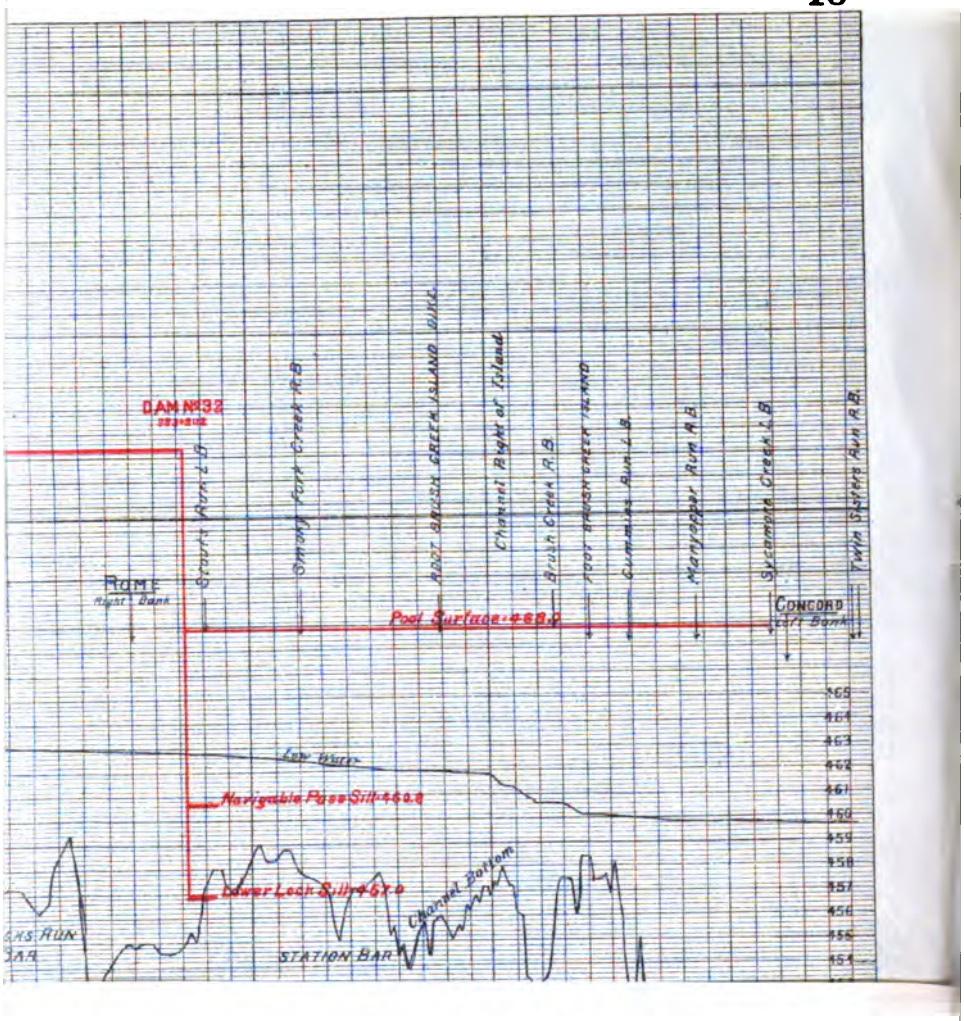

HIGH WATER 1884
PARKERSBURG
Left Bank
BELPRE
Right Bank
Rest Surface=572.2
Pool Surface=569.4
ZERO

Post Office street
Metal Bridge Tower
Wire Cut Nail Co.
Channel Right of Tow Line
City Town Creek R. R.
Post Old Town Tower
Third Creek Tunnel
Mill Pig Iron
Channel Right of Tow Line
Main Line R. R.
Third Creek Tunnel
Dam No. 38
545
544




PROCTORVILLE
Right Bank
GUYANDOTTE
Left Bank
Guyandotte River L.B.
Ohio River L.B.
HUNTINGTON
Left Bank
DAM Nº 25
DAM Nº 28
CENTRAL CITY
Left Bank




DAM Nº32
ROME
Right Bank
Pool Surface-468.0
Low Water
Navigable Pass Sill-460.8
Lower Lock Sill-457.0
CONCORD
Left Bank
Stony Fork Creek R.B.
Root Beech Green Island Bar
Channel Right of Island
Brush Creek R.B.
Root Beech Green Island
Cumbas Run L.B.
Mattlodge Run R.B.
Sycamore Creek L.B.
Twin Springs Run R.B.
Channel Bottom
STATION BAR
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464
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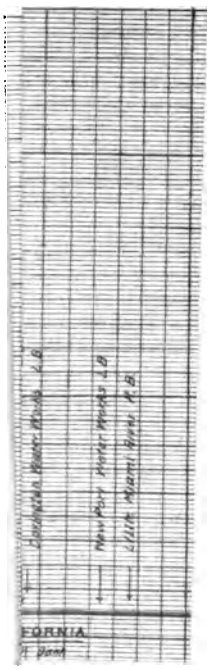
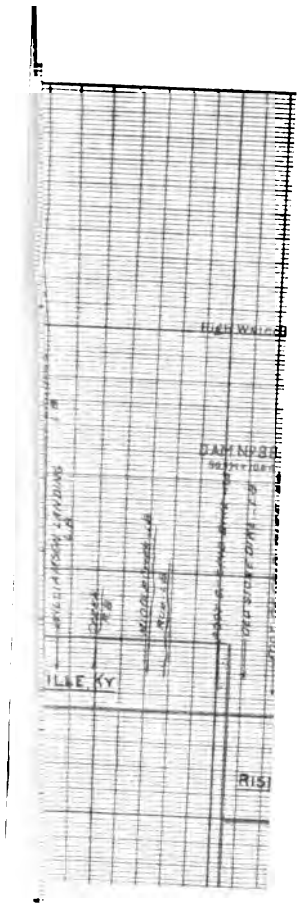
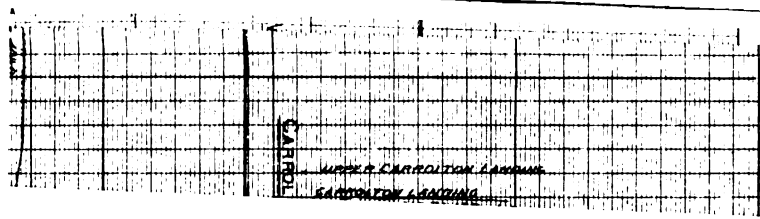
Strong flavour from Leaf
Weak flavour from Stalk


FORNIA


High Water
DAM NO 38
I L & E. Ky
R15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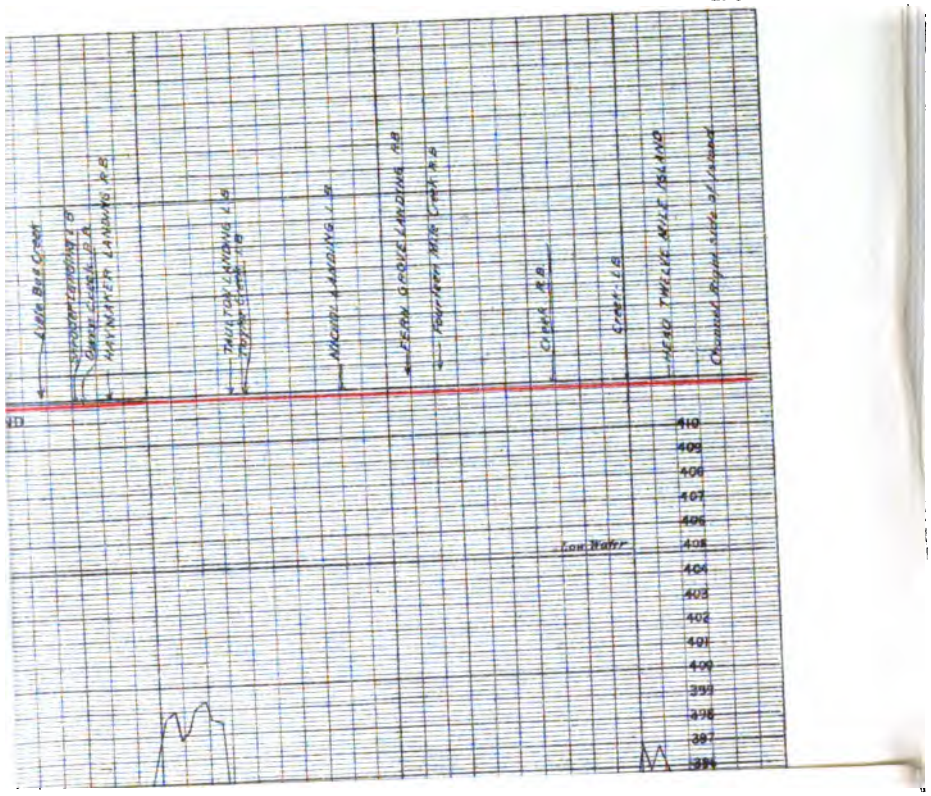
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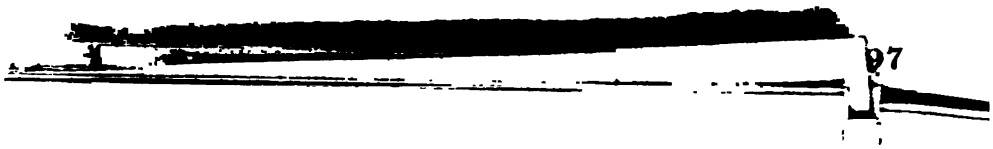

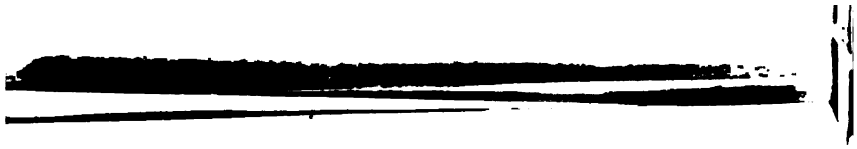

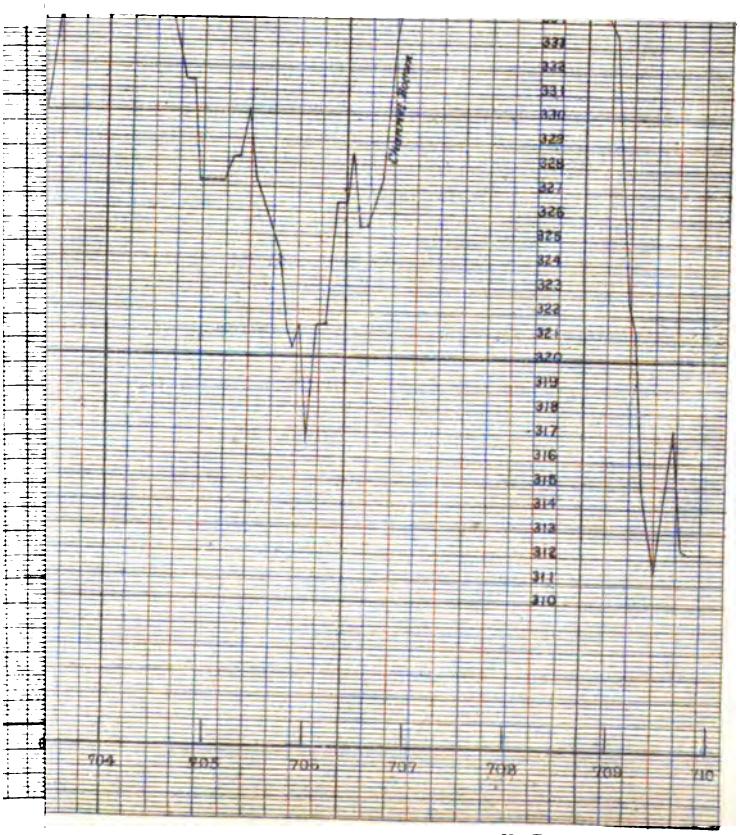
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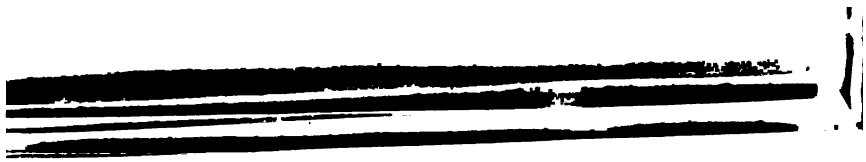

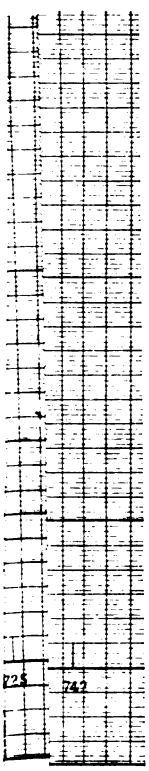
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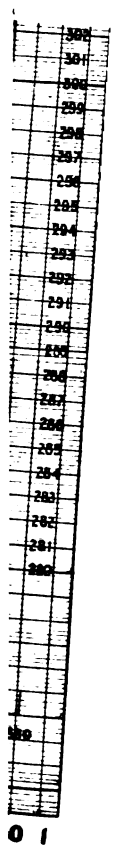

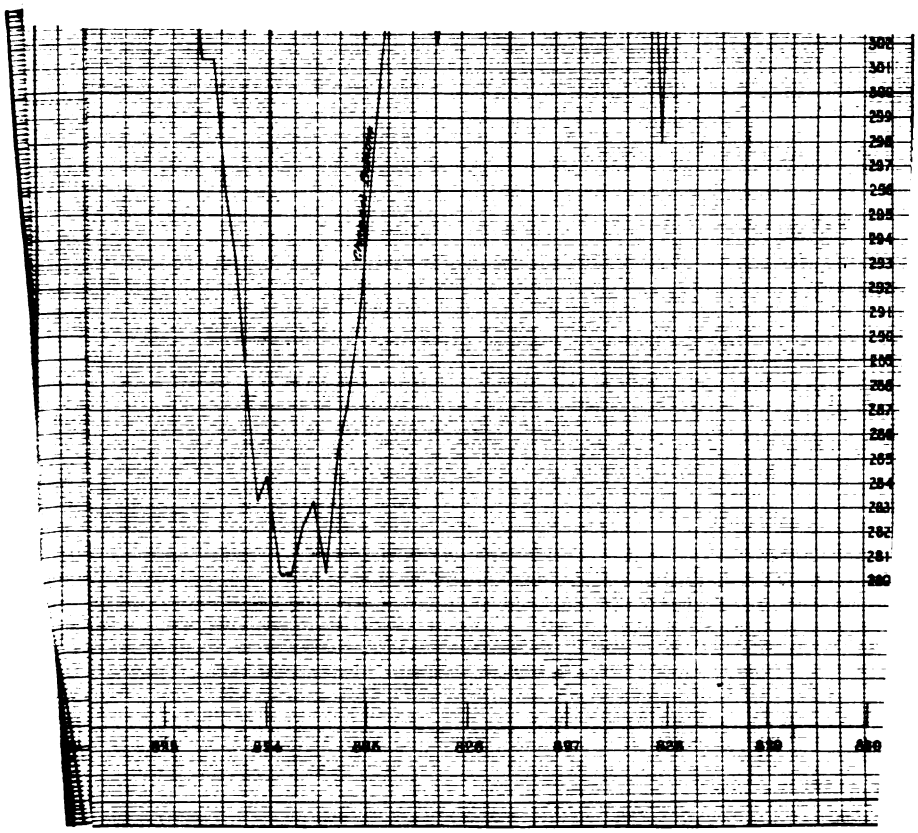

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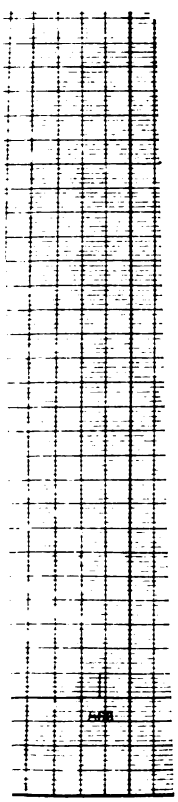

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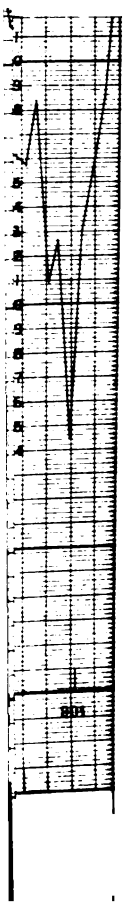

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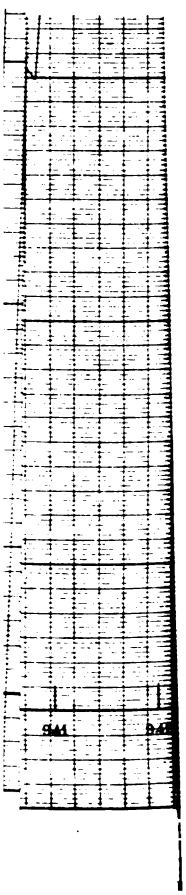
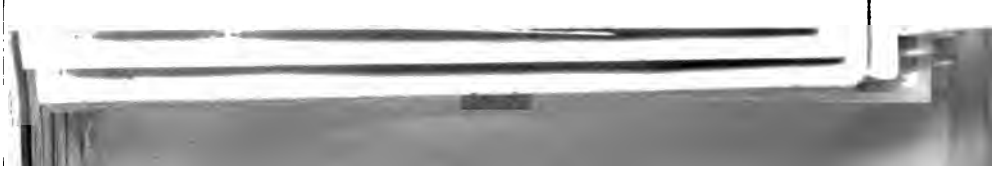
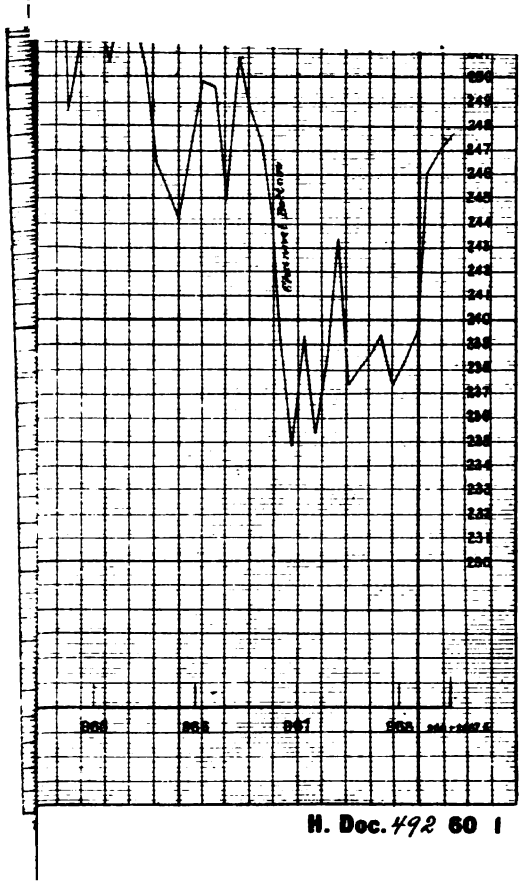




channel at Wabash Island. The map of Roberts survey shows a good depth of water past the island, the minimum being 5 feet and 5 inches. At the present



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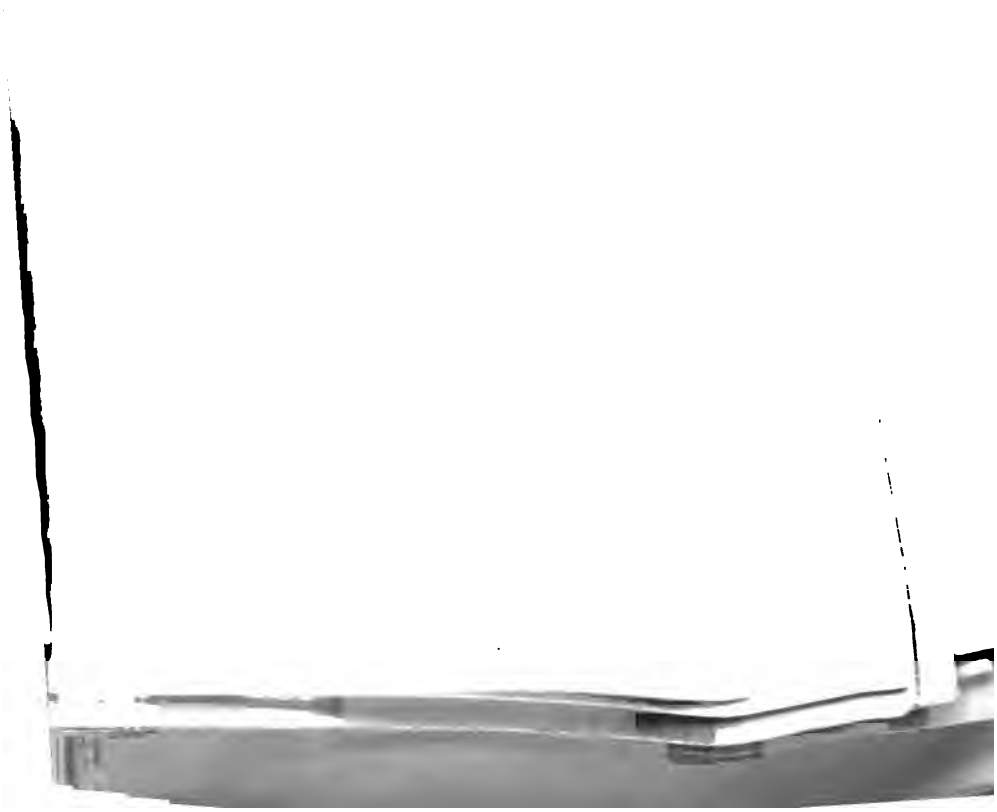

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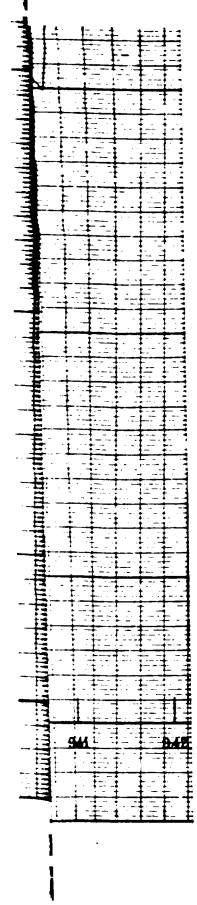

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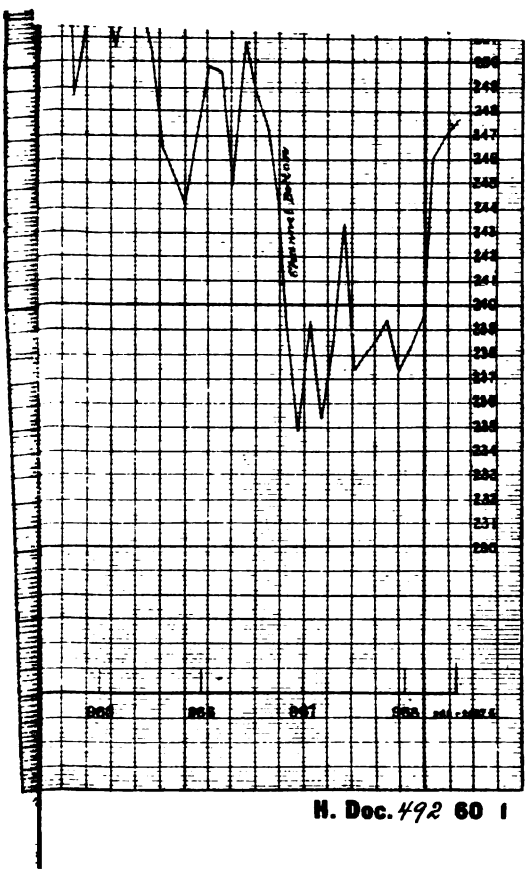

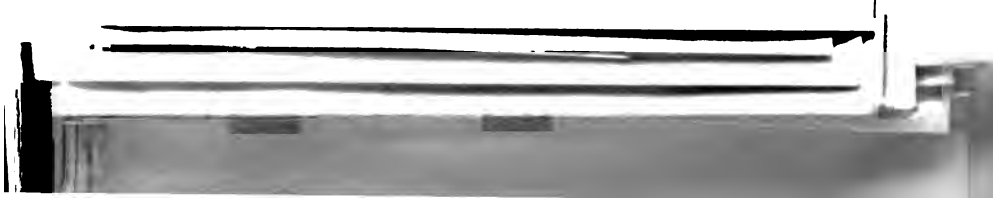

channel at Wabash Island. The map of Roberts survey shows a good depth of water past the island, the minimum being 5 feet and 5 inches. At the present time the crossing below foot of island is crooked and sometimes causes boats considerable trouble The surface indications of the channel bottom are for sand.

Raleigh bar, 843 miles below Pittsburg. This locality is not mentioned in the earlier river guides nor are any soundings given on the map of the reconnaissance of 1821. The map of Roberts survey shows a depth of from 7 to 8 feet. The channel in recent years crosses from the tow-head to a point about 845.7 miles below Pittsburg and in so doing passes over a hard reef of sand and gravel. This is not often a sticking point.

Browns Island, 845 miles below Pittsburg. In 1809 the channel lay close to the left (Kentucky) shore and presented no special difficulties. The reconnaissance of 1821 gives no soundings but shows a wide sand bar extending out into the channel from the island. The Pilot of 1849 mentions no bad place at Browns Island nor does the report of Roberts survey. The maps of Roberts survey give a minimum depth of 5 feet. The bar has in recent years occasionally made trouble for the low-water packets. The surface indications point to a sand bottom.

Bar above Shawneetown, Ill., 846.5 miles below Pittsburg. This bar is not mentioned in the Navigator of 1809, nor in the Western Pilot of 1849. The reconnaissance of 1821 does not indicate the bar in any way. The report of the Roberts survey describes the bar as one of the worst places on the lower Ohio, with a "sandy shoal and changeable channel." Prior to 1867 the channel was to the right of the bar, i. e., it followed the Illinois shore with a minimum depth of 1 foot 9 inches, but about 1867 it changed to the left of the bar. Mr. Roberts proposed a dam 3,500 feet in length extending from the Illinois shore, to confine the water to the Kentucky channel. The map of Roberts survey indicates three channels and old river men state that at different times each of these channels has been in use. A map of survey made in 1872 indicates the middle channel as the one then in use; about 1903 the channel followed its original course next to the Illinois shore. An estimate (1885) of the cost of constructing two dikes (extending from the Illinois shore) at Shawneetown bar was $156,016. There is nothing to indicate that any works for the improvement of the river channel at Shawneetown bar have ever been constructed. The channel bottom is composed of sand and often proves very troublesome, especially to ascending tows of empty coal barges.

Rock bar at Shawneetown, Ill., 848 miles below Pittsburg. A short distance below the public landing at Shawneetown a high ledge of rock makes out for a considerable distance into the channel of the river from the Illinois shore. It is not mentioned by the Navigator of 1809 nor the Western Pilot of 1849. The reconnaissance of 1821 shows the outline of the bar or ledge without soundings or other description. The report of Roberts's survey and the map of same describes the bar and several surveys made in connection with the levee at Shawneetown show the location of the ledge in question. The ledge includes sandstone, coal, a bastard marble, and a slaty formation; it is exposed only at low stages of the river and does not materially affect through navigation as boats both ascending and descending can easily pass above and outside of the bar.

Bowlesville bar (sometimes called Shawneetown bend), 850 miles below Pittsburg. This bar is not specifically described either in the Navigator of 1809 nor the Western Pilot of 1849; the course of the channel is, however, indicated on the map of reconnaissance made in 1821. The report of Roberts's survey and the maps of same describe the locality under the head of "Shawneetown Bend." The channel lies along the Illinois shore and is sometimes rather shallow but not particularly troublesome. The bottom is composed of gravel. Least depth shown on map of Roberts's survey 7 feet and 5 inches, but there is reason to believe that the minimum depth at times is much less.

Upper crossing just above Cincinnati towhead, 853 miles below Pittsburg. (Sometimes described as *Greens upper crossing.*) There is no mention of this bar in the Navigator of 1809 and the course of channel laid down on the map of reconnaissance of 1821 differs widely from surveys subsequent thereto. The Western Pilot mentions the locality very briefly under the caption "Cincinnati Bar," in so doing alluding to the middle bar described by Roberts. The report of Roberts's survey gives a description under the head of Cincinnati bar and towhead, ending with the note, "Will need improvement eventually." The map

of Roberts's survey indicates a least depth of 2 feet and 6 inches. The bar over which the crossing makes is composed of shifting sand. The crossing cuts across to the Kentucky shore rather squarely, but the locality does not appear to have been particularly troublesome in recent years.

Lower crossing opposite Cincinnati towhead about 854 miles below Pittsburg. (Sometimes called *Greens lower crossing* or *Bedford Point.*) The channel, after passing pretty close to Cincinnati towhead, crosses back toward the middle of the river.

The remarks made in connection with the upper crossing apply in general to this lower one; the bottom is composed of shifting sand, but the channel has a greater minimum depth, viz, 4 feet.

Caseyville, Ky., 860.5 miles below Pittsburg; *Tradewater Island*, 862 miles below Pittsburg; *Tradewater bar* down to 864.5 miles below Pittsburg. The Navigator indicates the channel as lying rather to the Illinois side of the center of the river, but states in the text that in low water it follows "pretty close to the left bank, between it and the bar," adding "This being a dangerous and conspicuous bar, it is a little strange how it escaped notice in the previous editions of the Navigator." The map of reconnaissance made in 1821 shows a bar along the Illinois shore extending from "Battery Rock" (nearly opposite Caseyville) to a point opposite the foot of Tradewater Island. Capt. R. E. Lee's report of 1839 omits mention of either Caseyville or Tradewater bars, but the Western Pilot of 1849 mentions both localities. The report of Mr. Milnor Roberts gives the trend of the channel but does not otherwise specifically describe the locality. The map of Roberts survey shows two channels passing over or around "Battery Rock towhead," of these the usual one lies near the Kentucky shore, the other being marked "channel cuts through occasionally." The least depth shown on this map is 2 feet and 4 inches opposite the upper end of Battery Rock towhead and 4 feet on a square crossing opposite the town of Caseyville; opposite Tradewater Island the least depth is given as 2 feet and 6 inches. The channel line is marked as "Shifting channel, sandy bottom, changeable sands." The channel at the lower end usually passes between Tradewater Island and the Illinois shore but within the past ten years the best water at very low stages has at times been found between the island and the Kentucky shore. The first work of permanent improvement at Caseyville was the dike completed in 1890. It is a curved training dike which extends from the Illinois shore near Battery Rock for a length of 3,400 feet. The channel opposite Tradewater Island continued to be so troublesome that it was proposed to construct a spur dike from the Illionis shore. This dike was completed in 1894, with a total length of 1,879 feet. Notwithstanding the scouring effect of the dikes built in 1890 and 1894 near Caseyville and mouth of Tradewater River, aided by dredging, the condition of the river was still so bad in the years 1899 and 1900 that additional work was considered necessary. A third dike some distance below the mouth of Tradewater River was begun in 1900 and completed in 1901. This third dike is a spur dike extending like the others from the Illinois shore and has a total length of about 1,400 feet. As a result of the construction of the three dikes above described, the channel has been somewhat deepened and materially straightened. A close examination of maps and records relating to the channel at Caseyville and Tradewater bar indicates that the bar is moving downstream and that other supplementary works will be required before any radical improvement is obtained. Except at points near the Kentucky shore just above Tradewater Island and just above the town of Weston, Ky., the river bed is composed of shifting sand.

Walkers bar, 870 miles below Pittsburg. This bar is mentioned in the Navigator of 1809 under the head of Hurricane bar as "a high, bold, and difficult bar to get around." It is not mentioned in Western Pilot of 1849, but is shown by name on the map of the reconnaissance of 1821, with a very abrupt crossing on which there is a minimum depth of 3 feet. Mr. Milnor Roberts describes the bar in his report and the map of his survey shows a minimum depth of 1 foot and 7 inches at the foot of the crossing. Here the channel runs pretty close to the Kentucky shore. The map indicates the presence of bowlders and irregular rock ledges along the Illinois shore from Cavein rock to Half Moon bar 3 miles lower down. By 1895 this Half Moon bar had scoured away The bar at Walkers has in recent years moved down stream. It is a shallow, crooked, and changeable piece of river, and will probably ultimately require improvement.

Hurricane Island, 873.5 miles below Pittsburg. The Navigator of 1809 describes the island as follows: "Though you pass the island on the left side

it stands nearest the left shore, having but a narrow channel compared to the right of the island, but the water is deep and rapid, the greater part of the river passing through it." This account is quite confused, but is understood to mean that the main channel then lay between the island and the Illinois shore, as it did prior to 1839, according to the map of the Roberts survey. The Western Pilot of 1849 says that "There is middling deep water to the left of it (the island), but it is too full of logs. Therefore you must go to the right of it." The map of reconnaissance made in 1821 shows the channel as lying between the island and the Kentucky shore; Mr. Milnor Roberts in his report describes the channel at the head of the island as very shallow and crooked; the map of his survey shows two channels at head of island uniting to pass between the island and Kentucky shore. To the right of the island two channels are also shown. These unite a little below the head of the island and continue down between the island and Illinois shore. Of the two last named one had not been in use since 1839 and the other not since 1860. To add to these complications there was a slough which cut across the head of the island and through this the water flowed at comparative low stages. The survey of 1894 shows a condition of the channels at Hurricane Island corresponding pretty closely with that observed at the time of the Roberts survey. The main channel was between the island and the Kentucky shore, the crossing above the island was very troublesome, and the back channel had continued to fill up. An examination of the same locality made in 1903 indicates continued filling of the channel between island and Kentucky shore. The condition of the channel at different times has been detailed at some length because of repeated requests from local interests that the ancient channel be restored. The question of changing the channel has been reported on by successive officers in charge of the district. The bed of the old channel is composed of sand and fine gravel, no rock being found in the numerous borings made at various points about the crossing, head of island, and back channel.

Pryors Island, 892.5 miles below Pittsburg. Under the above title (following the nomenclature of the Roberts survey) it is intended to describe the first island below the town of Golconda and distant therefrom about 2½ miles. The Navigator of 1809 and the Western Pilot of 1839 describe the island under a different name. The map of reconnaissance of 1821 shows the island under the name of "Second Sister," but gives no soundings in channel past the island. The report of Roberts survey mentions loose rock along the right of the channel and states that the channel at foot of island sometimes gets shoal and is changeable. The map of Roberts survey indicates minimum depth of 6 feet opposite the middle of island and shows the loose rock mentioned in report. A survey made in 1884 indicates not less that 6 feet of water in the channel opposite foot of island and the same year Pryors Island was mentioned as one of the troublesome localities that ought to be improved. A survey made in 1895 shows a minimum depth of 3.1 feet on a short crossing nearly opposite the foot of the island. The surface indications of channel bottom are sand on the island side of the river and gravel along the Illinois shore, but in 1879 a number of rocks were blasted and otherwise removed from a bar opposite the island.

Sisters Islands, 897 miles below Pittsburg. The channel at this point is described in the Navigator as follows (Second Sister): "This is a singular formed channel, crooked, deep, narrow, and rapid water." * * * The same authority continues with regard to the Third Sister, "but there must be some obstruction in the bed of the river * * * to occasion this sudden turn of the current." As there has been some confusion in the early nomenclature of the islands in this vicinity it is possible that the obstruction alluded to may have been the one removed from channel near Pryors Island. The western Pilot of 1849 mentions a rock dam in connection with the Third Sister Island. The map of reconnaissance made in 1821 shows a minimum depth of 4½ feet in channel a little below the Third Sister and but 3½ feet a little lower down. Capt. R. Delafield reported in 1833 on work constructed at Sisters in the preceding year and was of the opinion that "a very great change had been made in the whole bed of the river." An old survey, undated, but believed to have been made in 1835, shows two stone dikes, one on each side of the channel then in use. The rock dam mentioned in the Western Pilot of 1849 was probably one of these dikes. Capt. R. E. Lee in 1839 in referring to the works at Sisters says that it "shows its importance if fully carried out." The report of Mr. Milnor Roberts alludes to the large bars of sand and gravel on both sides of the channel and to a rock bar on right at mouth of Bay

Creek. The map of Roberts survey shows a minimum depth of 5 feet at head of Second Sister and the same depth on crossing near the Illinois shore. Rock ledges are shown extending along the right shore from Pryors Island nearly to the Second Sister, also rock ledges from Bay Creek to below the town of Bay City. Some small rocks were removed from the channel at Sisters in 1879, but the exact location can not be identified and it is possible that they may have once formed a part of the early stone dikes. Sisters was mentioned in 1884 as one of the troublesome places demanding improvement and in 1885 the cost of such improvement was estimated at $139,300. A survey made in 1895 shows a complete change as compared with early surveys or written description. Portions of two dikes were found at this time, one believed to have been built about 1832 and the other in 1832–1854. The records indicate still another dike (or possibly a fragment of one of those just described), but it was covered that it could not be traced. The survey of 1895 indicated depth of but little more than 2 feet at points near the head and foot of Sisters Islands. The rock ledge already described as shown on map of Roberts survey is shown on the map of 1895 as having an elevation of from 6 to 25 feet above low water. The indications of channel bottom point to sand, and numerous borings made to a depth of 10 feet below low water found no rock. Measurements made in connection with the survey of 1895 indicate a discharge of 9,149 to 9,174 cubic feet per second. The records of the United States engineer office at Cincinnati indicate no works of improvement at Sisters except those constructed from 1832 to 1854, inclusive.

Cowpers bar, 905 miles below Pittsburg. The locality is not mentioned in the Navigator of 1809 nor the Western Pilot of 1849. It is not mentioned in the text of Mr. Roberts's report, but his map indicates the outline of a bar in the middle of the river marked "Shoal sometimes dry." It is situated about 1 mile above the head of Dog Island. The map of reconnaissance made in 1821 indicates a minimum depth of 3 feet on the crossing of the bar and a survey made in 1884 indicates about the same depth. The surface indications of channel bottom point to sand and fine gravel, although a large rock bar is found at the head of Dog Island about 1 mile below. An estimate for improvement in 1885 involved a total of $111,440, but the work was never carried out. The more recent records of the river indicate that Cowpers bar is a place where the boats often have a great deal of trouble.

Dog Island, 906.5 miles below Pittsburg. This island is not mentioned in the Navigator of 1809, but is shown on map of reconnaissance made in 1821 with two channels passing from the foot of Dog Island around Cumberland Island just below. The Western Pilot of 1849 describes the island and concludes as follows: "From the foot of Dog Island Captain Shrieve has built a dam across to the head of Cumberland Island for the purpose of making the main channel go to the left of Cumberland Island, but it is a failure, and at low water you must pass through a small gap in the dam." The report of Mr. Milnor Roberts also mentions the dam as being then in a damaged condition and his survey shows the two channels leading from foot of island around Cumberland Island. A rock ledge is shown on the Roberts survey and also on a survey made in 1884. This ledge extends from a point on the Illinois shore about 1 mile above head of island nearly to its foot. There is usually a good depth of water in channel past Dog Island. The channel bottom so far as known is sand and fine gravel.

Cumberland Island, 907.25 miles below Pittsburg. This island is barely mentioned in the Navigator of 1809 as one of the camping places of Burr in the winter of 1806–7. The Western Pilot of 1849 gives no mention of the channel at this place. The map of reconnaissance of 1821 shows a minimum depth of 2 feet in channel just below the island. The old dam extending from Dog Island to Cumberland Island is shown on a sketch map made by direction of Lieut. A. H. Bowman and dated 1835; no depths are indicated in the channel. The dam was begun in 1832 and repaired in 1839 and 1854. The report of Mr. Milnor Roberts speaks of an extremely shoal place from "Pull-tight" across to Old Smithland. This appears to be the place at which the map of reconnaissance gives 2 feet. The map of Roberts survey shows a minimum depth of 3 feet to the right of and opposite Cumberland Island and 3 feet and 4 inches opposite Old Smithland. A sketch map of the locality made in 1855 shows the main channel between island and Kentucky shore with a minimum depth of 4 feet at head and 1 foot and 6 inches at a point about three-fourths of a mile below the foot. The dam between Dog and Cumberland islands was intended to turn the principal low-water flow of the Ohio directly past the mouth of Cumberland River. A map of survey made in 1871 shows the channel still in

the Kentucky chute, with a minimum depth of less than 2 feet near head and 1½ feet on either side of the tow-head below island. The old dam was repaired in 1872, 1873, and 1874, but the low-water season of 1876 demonstrated the fact that the construction of the dam was a radical error and authority was granted to open a gap. This was done in November, 1876. The surface indications of channel bottom point to sand.

Cottonwood bar, 912.5 miles below Pittsburg. This bar is described, but not by name, in the Navigator of 1821. The channel then led pretty close to the left bank. The description of the bar in the Western Pilot of 1849 indicates the presence of several crossings. On the map of reconnaissance of 1821 the minimum depth on crossing at foot of bar is given as 3 feet. The report of Mr. Milnor Roberts gives scant mention of the bar. His map shows a minimum depth in channel of 4 feet at head of bar and 8 feet at foot. During the low-water season of 1895 Cottonwood bar caused as much trouble as any place on the river. There were at that time three crossings of the bar of which the one at foot contained the least water. The channel is generally wide, flat, shallow, and very changeable; the bottom is composed of sand.

Tennessee Island, 918–920 miles below Pittsburg. This locality is described in the Navigator under the heads of "Tennessee or Cherokee river (upper mouth) and Tennessee Island." There were then two islands immediately below the upper mouth of the Tennessee; the upper island was small, hardly more than a towhead, so that there were, in fact, three mouths of the river, but one so small that it was seldom used. On the Illinois side of the Ohio River at this point there was a little bay sometimes used as an ice harbor and described as follows: "Opposite the upper mouth of Tennessee and on the right bank of the Ohio is a neck occasioned by a slip of the bank, called Dickeys Elbow, from the circumstance of a boat getting into it in time to be saved from the driving ice in February, 1811, when the four or five other boats were stove at that place." The main channel, according to the same authority, in 1821 lay about one-third of the river from the lower point of the island. The map of reconnaissance made in 1821 shows two islands in the mouth of the Tennessee with a small towhead lying between them, while a large sand bar extended on the Ohio River side past all three; the minimum depth is given as 3½ feet on the upper crossing. The text of Roberts's report barely mentions Tennessee Island, but the map of his survey shows the island with a channel on either side; of these the one between the island and Kentucky shore had from 8 to 14 feet except at head, where the depth was only 5 feet. The main channel, lying about the middle of the river, shows a least depth of 13 feet. A third channel branched from the one last described and crossing from near head of island ran close to Illinois shore between it and a large bar; the minimum depth in the last named was 3 feet. About the year 1884 the Ohio River threatened to cut through Livingstone Point, a neck of land extending for some distance between the mouth of the Tennessee and the Ohio River, making, in connection with Tennessee River, an ice harbor for the city of Paducah, Ky. An examination was made and the report thereon expressed the opinion that "the interests of commerce are in no way interfered with by this erosion." A second examination made in 1890 resulted in a report favorable to the protection of Livingstone Point at an estimated cost of $194,040, and in the following year an allotment was made for the work in question from the appropriation for improving the Tennessee River. The channel bottom past Tennessee Island is composed, so far as known, of sand and gravel.

Little chain, 932 miles below Pittsburg. The Navigator (edition 1821) alludes to this locality as follows: "Little chain of rocks—channel is near the middle of the river;" no special difficulties are alluded to. The Western Pilot mentions Little chain under the head of Fort Massac. It speaks of a submerged rock and large rocks along the right shore near the water's edge. The map of reconnaissance shows Little chain with rocks lying in the river along both sides of the channel. The report of Mr. Milnor Roberts states that the channel here "crosses from the Kentucky to the Illinois shore between two large gravel and sand bars. After crossing in here there are rough, ugly rocks on both sides of the channel." The map of Roberts's survey indicates a minimum of about 5 feet near the upper end of the crossing. A survey of the locality made in 1874 indicates several large rocks lying to the left of the channel. Of these, the "Upper Center rock" and "Middle rock" were the most prominent, standing as they did from 2 to 3 feet above the surrounding bottom. A survey made in 1884 shows scant 4 feet on the crossing just before it joins the channel along Illinois shore. To the left of the channel lie two large bars inscribed "Smooth and hard cement gravel bar." The minimum depth

through the channel is scant 4 feet. The reef called Upper Center Rock, as well as some outlying rocks, was removed in 1880. In 1882 the officer in charge of district considered that no further work was needed at Little chain, but in 1888 there were some rocks and cemented gravel in the middle of the river that required removal. A survey made in 1902 showed a minimum depth on the crossing of 1.9 feet; the bottom at this point was gravel. Below the crossing there was then a practicable channel with a depth of nearly 6 feet.

Hillermans, 939 miles below Pittsburg. This locality is not described in the earliest records, but is shown on the map of Roberts's survey as "Hillerman." These rocks in 1888 were considered dangerous and requiring removal. One of the United States dredges was injured on these rocks in 1884. In 1901 the rocks were found to be "blocks of cemented gravel, forming a reef, which extends diagonally upstream from the lower end of the landing;" most of these rocks or blocks of cement gravel were removed, but a few submerged ones and also a few along the shore could not be reached by the dredges at that time. From the fact that the obstructions alluded to have not been frequently mentioned it is not unlikely that they are sometimes covered by shifting sand.

Grand Chain, 942.5 to 948 miles below Pittsburg. This locality is mentioned in the Navigator, with the directions to run the channel "one-third of the breadth of the river from the left shore until you are past the last rocks in the middle of the river, then bear over toward the right shore to avoid a sand bar." The map of reconnaissance made in 1821 shows the channel lying in the middle third of the river with rocks singly and in clusters scattered along to the right of channel. The minimum depth at head of chain is given as 3 feet. The Western Pilot describes the locality under the caption "Wilkinsonville," with directions for running channel which agree pretty closely with those given in the Navigator. The report of Mr. Milnor Roberts describes the channel as crossing to within a quarter of a mile of the Illinois shore and following at about that distance from the shore to the foot of chain. He further says that the channel below Wilkinsons becomes filled up with sand until it is extremely shoal. The map of Roberts survey gives a minimum depth of 2 feet on crossing at head of chain, 2 feet opposite Jacksons rock, and from 2½ to 4 feet lower down. A survey made in 1872 shows many large rocks scattered along to the right of channel, with the channel bottom generally fine gravel and sand. A survey made in 1874 gives a minimum depth of about 3 feet on crossing at head of chain; lower down the depths in channel vary from 3½ to more than 6 feet. It was hoped that the channel at Grand Chain might be improved so as to give a depth of 6 feet, but a survey made in 1887, after the construction of two of the dikes, showed a minimum depth of less than 4 feet in the channel near Upper Dike. Three dikes were ultimately constructed at Grand Chain extending from the Illinois shore. The lower dike was completed in 1883, the upper in 1884, and the middle dike in 1892. Grand Chain had been a very dangerous locality during the early days of navigation on the Ohio. A number of rocks were removed by Captain Shreve as early as 1829 and 1830. Between 1876 and 1887 the clusters of rocks known as Grenadier, Arkansas, and Jackson rock were pretty thoroughly eradicated. A further improvement of channel at head of Grand Chain was proposed in 1903 by the construction of two spur dikes extending from the Illinois shore and one short low dam closing channel between bar and Kentucky shore. This improvement it was believed would help the channel between Ogdens Landing and the Chain. For lack of funds this work has never been carried out. The material to be encountered in future radical improvement at this locality will be sand, gravel, both loose and cemented, and loose or detached rock.

Mound City, 958 miles below Pittsburg. The Navigator describes the channel at this locality as lying between Cache Island and the bar on right shore which is now known as Mound City towhead. Sometimes a narrow channel between towhead and Illinois shore was used by keel boats. The Western Pilot states that the channel "goes in to the right shore a little below the bar at a house on a little mound." The report of Mr. Milnor Roberts describes the channel as crossing in to Mound City at lower end of Cache Island. The maps of Roberts survey indicate the main channel crossing gradually from the middle of river nearly opposite the foot of Mound City towhead to a point a little above the United States navy-yard, where in 1868 a fleet of ironclads was lying up. The minimum depth in the channel was about 4 feet. Roberts map also shows another channel to the east of the one just described, speaking of it as "Occasionally the best channel at low water." The depths shown are from 4½ to 5 feet. The Mound City bar is shown as a sand bar extending

from a point little above the navy-yard to Cache River. There is no record of any surveys at Mound City between the time of the Roberts survey and 1887; a survey made in the latter year gives a depth on a practicable channel at crossing about 900 feet above the furniture factory of only 2½ feet. The map shows the presence of a great deal of so-called rock extending across the channel at its upper end. A note on the map states that the borings were made in 1892; it further states: "The rock noted on the map is believed to be the same as that found at other points in the vicinity and is composed of pebbles cemented together by iron oxide and varies in hardness, some parts of the ledge being soft enough for removal by dredging, while other parts require blasting. This rock, so-called, usually occurs in strata varying from 6 inches to 3 feet in thickness and overlays softer material."

A contract for the construction of the two dikes was approved June 30, 1893. The work had not been completed by the end of fiscal year 1895, but the action of the dikes in connection with dredging near the head of channel had by that time been "very beneficial." The length of channel through the upper bar was described in 1899 as about 4,500 feet, divided up as follows: "1,600 feet in gravel, 1,100 feet in cement gravel, 1,000 feet gravel, and finally 750, which has been explored only a short distance, but of which the upper end proves to be extremely hard." Contracts made for the construction of dikes at Mound City with Frederick Hartweg 1893 and James Short 1900 having been terminated or annulled a new contract with some modifications of the original conditions of construction was entered into with Oscar F. Barrett and approved June 23, 1905. A considerable amount of work was done under this contract during the season of 1905, but owing to continued high water during the seasons of 1905 and 1906 the dikes have not been completed. The dredging done in connection with the channel near the dikes at Mound City is described in another report specially devoted to dredging. No complete survey of Mound City has been made since the resumption of work on dikes in 1905, but a survey made in December, 1902, shows the channel in that year as still both narrow and tortuous. In 1902 a considerable deposit of sand was observed in the dredged channel. It is probable that much of this sand scours out during low-water stages of the river.

NUMBER 3.

MEMORANDUM OF BORINGS MADE ON BARS IN THE OHIO RIVER BELOW THE MOUTH OF THE GREEN RIVER.

[Prepared by R. R. Jones, assistant engineer, under the direction of Lieut. Col. William T. Rossel, Corps of Engineers, U. S. Army.]

Slim Island, 820.5 miles below Pittsburg. Borings were made in 1904 on the bar and in the channel on each side of Slim Island, extending from the head of the island to a point about two miles below same. These borings were carried to a depth of 10 feet below low water; no material other than sand was encountered.

Caseyville and Tradewater, 860.5 to 864.5 miles below Pittsburg. Borings were made in 1892 from a point 4,000 feet above Tradewater River to the foot of Tradewater Island and extending entirely across the Ohio River. These borings were carried to a depth of 10 feet below low water; no material was encountered other than soft shifting sand.

Hurricane Island, 873.5 miles below Pittsburg. Borings were made in 1894 about the head of the island and between the island and the Illinois shore. These borings were made to depths varying from 8.5 to 9.5 feet; no material other than sand and gravel was encountered.

Sisters Islands, 897 miles below Pittsburg. Borings were made in 1893 on the bar to the right of and below Sisters Island partly on the line of the old channel. These borings were carried to a depth of 10 feet below low water. No material other than sand and gravel was encountered.

Mound City, 958 miles below Pittsburg. Borings were made in 1892 across the channel at several localities nearly opposite the head and middle of the bar. These borings were carried to varying depths. The rock found was a cemented gravel in strata having a thickness of from 6 inches to 3 feet and lay at a depth of from 2 to 6 feet below low water. This so-called rock is of varying degrees of hardness; some can be removed by dredging alone, while other portions require blasting preliminary to dredging. The harder material is nearer to Cache Island.

APPENDIX V.

MEMORANDUM AS TO HYDRAULIC DREDGING ON THE MISSISSIPPI RIVER, BETWEEN THE OHIO AND THE MISSOURI RIVERS.

[Prepared by Wm. S. Mitchell, assistant engineer, under the direction of Lieut. Col Clinton B. Sears, Corps of Engineers, U. S. Army.]

The performance of only two dredges (*Nos. 3* and *4*) of the various dredging devices operated within the past ten years in this district furnishes data at all appropriate for a basis for the construction of a dredging plant for the low-water relief of the lower reach of the Ohio River, which in general characteristics of banks, bed, and bar composition may be considered comparable to the Mississippi between St. Louis and Cairo.

These two vessels are nonpropelling, hydraulic suction dredges, with steel hulls, and are identical in design, fittings, and capacity (28-inch diameter discharge of dredging pump) and each, in operation, requires the services of a small steam tender, a pile driver, a storage barge, and two fuel barges and, in addition, the occasional use of a towboat to move the whole from bar to bar. None of these extra vessels, however, were constructed specially for dredging service, but are drawn during the low-water season from the general plant of the district and the necessity for all, except fuel barges and the use of a towboat for the distribution of the latter and necessary supplies, may be avoided by the construction of self-propelling dredges, although it is an open question whether the latter is the more economical plan for a district already equipped with such plant for the general work of channel regulation.

Numerous changes have been made in these dredges as the result of experience in their use, but none are of such nature as would have added to the original cost had they been embodied in the original design. Therefore, in the tables herein, the original cost is given as the value of a dredge of the present efficiency.

The deterioration of the dredges and attendant plant, the current repairs and expenses, both for operation during the short dredging season and for caretaking and overhauling during the remainder of the year, are all charged against the dredging account, whether the work done was little in seasons of favorable river stages, or much in unfavorable seasons.

Renewals and betterments are charged directly to each dredge and are ultimately absorbed by the deterioration charges which enter into the account of dredging expenses of each season. Of betterments, none have been made in the sense of additions to the original plant, although modifications have been made, which, as has been stated, might have been the original design.

The capacity for work is based on performance during the present season since the increased efficiency due to changes made is marked and the cost of operation, maintenance, etc., the same as for former years.

TABLE I.

Original cost of one dredging plant.

Contract price	$102,400
Office expenses, designing, etc., superintendence during construction, extra contract outfit, etc	9,157
One dredge, pontoons, and pipe line complete	111,557

Original cost.

2 fuel barges	$7,350
1 storage barge	3,675
1 pile driver and outfit	4,500
1 steam tender and outfit	6,000
Attendant plant for one dredge	21,525

The average cost of the three steamers used as needed in towing these dredges is about $44,300 and one steamer is capable of tending about 5 dredges within a district of 175 miles, moving them, distributing fuel and supplies, sounding, and examining bars and shoals, etc. The proportionate cost for each dredge unit is, therefore, about $8,860; the total original cost per nonpropelling dredge unit, $141,942.

In this connection it may be stated that the two self-propelling dredges now being added to the plant for this district will cost about $165,000 each, to which must be added the value of the outfit, fuel barges, and proportionate part of the cost of a steamer for distribution of fuel, subsistence stores, and supplies, which will probably add $17,000 to the above, but as the capacity of the new dredges will be 30 per cent greater than that of the older vessels their cost for the same capacity will be slightly less, and it is also expected that the cost for operation will be less.

Repairs, etc., to plant.—Extensive repairs and betterments to the dredges proper have been made only during the first and last years of operations and have consisted wholly of alterations of the original designs, and although greatly increasing the efficiency, have not added either machinery or plant. The cost of these alterations for each dredge has been $4,306. The attendant plant and towboats have also been altered and repaired as needs for dredging and other service indicated. The total of all costs for these items for each dredge unit has been or will be absorbed proportionately into the various services rendered by the vessels in the depreciation charges which are entered each half year against the work accomplished. Depreciation for steel plant is taken at 3 per cent and for wooden plant at 7½ per cent semiannually of the value at the end of the period.

TABLE II.—*Cost of Field Operations.*

		Per month.
Labor, subsistence, fuel, during dredging season, three and three-fourths months (August 15 to December 5)		$3,765
Tender		160
Barges		216
Pile driver		139
Small boats (flats, skiffs, yawls)		85
Towboats		207
Materials, field repairs, etc		39
Deterioration	$466	
Current repairs, renewals, etc	87	
Plant account (fleet)	214	
Labor and material account (engineer depot)	97	
General expense account, superintendence, etc	56	
United States engineer office	60	
		980
Monthly expense during working season		5,591
Monthly expense during idle season		980
Total yearly expense, 1 nonpropelling dredge plant, four months dredging, eight months idle		30,204

Capacity.—Each dredge as originally built operated two unlined pumps, each 20 inches diameter of discharge, which were worn out in service and were replaced in time for use during the present dredging season by a single-lined pump of the united capacity (28 inches diameter discharge) of those removed. The length of discharge pipe used is 300 feet to 400 feet, which has been found sufficient to dispose effectually of the spoil. The new pumps have been in operation during the current incomplete season. No capacity tests as such have been attempted, but the prisms of material moved on 8 bars, on all of which good channels have been obtained, have been carefully computed from the soundings and the results are shown in the following table:

Table of work done.

[Averages for 1-dredge plant on 4 bars.]

Total time in commission	hours	2,355
Total time in operation, including cleaning boilers, etc	do	1,662
Total time dredging (actual pumping sand)	do	717
Total amount of material dredged	cubic yards	591,100
Total amount of material dredged per hour	do	825
Total length of single cuts	feet	60,632
Total length of dredged channels	do	12,712
Average depth of cut	do	6.2
Average width of channel	do	225

The total time in commission was of course based on twenty-four hours per day, but the time in operation and dredging was during the early part of the season twenty-four hours and during the latter part sixteen hours per day.

The results given show practically for a dredge plant of this capacity and average material of this river ability to deepen by 6 feet 2½ miles of channel 225 feet wide in one hundred days in operation or forty-five days pumping.

Increase of capacity for the same plant can undoubtedly be obtained by the use of cutters in the suction head to feed constantly a high percentage of solids to the pump, although this will increase the initial cost of the plant and its maintenance and operating expenses.

By the present method of jet agitators only 10 per cent of the flow at a velocity of 14 feet per second is solids. This is probably the average, the load oscillating between 5 and 15 per cent. With mechanical cutters this average could probably be doubled.

The river stage throughout the present dredging season has followed closely the average for forty years and consequently is almost typical of the ordinary conditions.

Eleven bars were, or threatened to become, obstructive and have been successfully dredged through (4 by each of the dredges under discussion) with excellent resulting channels. Three other bars have been under observation, but have not yet become shoal, and as the end of the season of open navigation is approaching the number of obstructive bars in the 175 miles under care may be taken at the above figures.

APPENDIX VI.

MEMORANDUM AS TO HYDRAULIC DREDGING ON THE MISSISSIPPI RIVER, FOR THE OHIO RIVER BOARD, BY LIEUT. COL. CLINTON B. SEARS.

[Acknowledgments made to Capt. Wm. B. Ladue, Corps of Engineers, U. S. Army, secretary Mississippi River Commission, for valuable assistance.]

The following data relates to the 6 best dredges in use by the Mississippi River Commission as to first cost, repairs and betterments, operating expenses, deterioration, and results obtained.

These dredges are the *Delta*, *Epsilon*, and *Zeta*, nonpropelling, requiring services of a tender and pile sinker, and the *Iota*, *Kappa*, and *Flad*, self-propelling.

TABLE 1.—*Original cost of plant.*

Name.	Dredge.	Tender.	Pile sinker.	Total.
Delta	$124,940	$47,862	$2,884	$175,68
Epsilon	102,000	47,862	2,884	152,7
Zeta	109,000	47,862	2,884	159,7
Iota[a]	100,480			100,48
Kappa[a]	134,600			134,60
Flad[a]	134,600			134,60

[a] Self-propelling.

Average cost for nonpropelling	$162,726
Average cost for self-propelling	123,227
Average cost of one plant	142,976+

To the above first cost should be added "Alterations and betterments" as shown in next table and distinguished from "Repairs and renewals," as these alterations were due to experience gained and could be embodied in specifications for new plant without materially affecting the ultimate cost.

TABLE 2.—*Repairs, etc., to plant.*

Name.	Date of delivery.	Repairs and renewals.	Alterations and betterments.	Totals.	Total for three years, Jan., 1902, to Jan., 1905.
Delta	August, 1897	$28,761.58	$20,634.20	$49,395.78	$18,022.67
Epsilon	March, 1898	21,881.17	1,094.35	22,475.52	7,428.54
Zeta	——do	20,318.06	1,128.17	21,446.23	7,385.11
Iota	August, 1900	13,155.28	8,174.19	21,329.47	10,892.46
Kappa	July, 1901	7,533.16	4,664.95	12,198.11	12,198.11
Flad	——do	6,605.63	4,737.61	11,343.24	11,343.24
Tenders	October, 1899	———	———	*10,718.93	———
Pile sinkers	December, 1898	———	———	*883.15	———

*Average of 4.

Repairs and renewals, average of 6 ..... $16,292.48
Repairs and renewals (omit *Delta*), average of 5 ..... 13,798.66
Alterations and betterments, average of 6 ..... 6,738.91
Alterations and betterments (omit *Delta*), average of 5 ..... 3,959.85

As most of the extensive alterations occurred in the earlier years of the plant the average of the last three years is regarded as a better guide for future estimates than the average of the last eight years.

Repairs, renewals, etc., for last three years:
Average of 6 ..... $11,211.69
Omit *Delta*, average of 5 ..... 9,849.49

TABLE 3.—*Cost of field operations.*

Name.	Number of seasons operated.	Total cost field operations.	Total hours in commission.	Total working hours.	Average cost per month in commission.	Cost of material used in field repairs.	Average cost per month excluding field repairs.
Delta	7	$135,651.40	16,648	7,605	$5,866.71	$4,595.91	$5,667.95
Epsilon	7	120,444.42	14,891	5,159	6,823.65	4,310.65	5,615.23
Zeta	7	100,114.57	13,243	4,087	5,443.06	3,872.81	5,232.51
Iota	5	80,942.51	12,137	3,127	4,801.73	3,290.19	4,606.55
Kappa	4	58,780.57	9,411	2,882	4,497.08	1,881.42	4,353.14
Flad	4	62,218.32	9,561	3,200	4,685.41	997.79	4,610.27

Including field repairs, average monthly cost for operating a nonpropelling dredge with tender and pile sinker $5,711.14
Same for a self-propelling dredge 4,661.41
Excluding cost of material for field repairs, the monthly cost of operating a nonpropelling plant 5,505.23
Same for a self-propelling plant 4,523.32

In office of Mississippi River Commission for purpose of estimates, monthly cost of operation in field, including field repairs:

For nonpropelling plant is taken at $5,500
For self-propelling plant is taken at 4,500

Assuming that needed repairs are made each year and the dredges kept in a condition of highest efficiency, the boilers, engines, and machinery should last twenty years and the hulls a like period, after which replating may be needed. The Mississippi River Commission estimates 5 per cent for deterioration annually.

The rated capacity of these dredges, based on an assumed velocity of 13 feet per second in the discharge pipe and a carrying capacity of 10 per cent of sand, is 1,200 cubic yards per hour for the *Delta* and 1,000 cubic yards per hour for each of the other dredges, delivered through 1,000 feet of pipe. In tests of the *Delta*, *Epsilon*, and *Zeta*, made in 1897, the following results were obtained:

TABLE 4.—*Capacity tests.*

Dredge.	Average velocity per second.	Per cent of sand.	Average cubic yards of sand per hour.
	Feet.		
Delta	15.10	14.69	1,[illegible]
Epsilon	16.78	20.68	2,[illegible]
Zeta	16.48	11.14	1,[illegible]

Field tests of these dredges, made under the conditions of actual dredging in 1898, gave the following results:

TABLE 5.—*Field tests, 1898.*

Dredge.	Duration of test.	Average cubic yards per hour.	Remarks.
	Hours.		
Delta	27.38	1,295	Sand, maximum rate 2,550 cubic yards per hour.
Epsilon	24.98	1,305	Sand.
Zeta	62.92	652	Blue clay and sand.

Tests made in 1902 where only water was pumped. Figures in the following table deduced on the assumption that had water and sand been pumped the output would have been essentially the same at the same velocities.

From tests made during actual dredging it is believed that 15 per cent of sand is not an unreasonable percentage in free-flowing material.

TABLE 6.—*Capacity tests.*

Dredge.	Average velocity.	Cubic yards per hour.		Length of pipe in feet.
		15 per cent sand.	10 per cent sand.	
Delta	16.65	2,160	1,440	[illegible]
Epsilon	21.20	2,404	1,600	[illegible]
Iota	18.36	2,114	1,400	[illegible]
Kappa	21.35	2,342	1,560	[illegible]
Flad	16.75	1,944	1,296	[illegible]
Iota*	21.30	2,342	1,560	[illegible]

*With shrouded runner.

It is concluded that the pumps of any of these dredges are capable of handling from 2,000 to 2,500 cubic yards of sand per hour and that the capacity of a dredge is limited only by the rapidity with which the dredged material can be loosened and fed to the pump.

In actual service these figures are not approached, though several of the dredges removed averages of 1,000 yards per hour or over for several consecutive hours in favorable material. In December, 1904, working in exceptionally favorable material, the *Epsilon* removed an average of 1,972 yards per hour for five consecutive hours, but how much was actually pumped and how much carried away by the current could not be determined.

Taking the averages of all the dredges for the past four years in all classes of material from tenacious clay, on which the jet has but little effect, to light sand, and considering only the time spent in actual dredging, the following average actual capacities are obtained:

TABLE 7.—*Field capacity.*

	Yards.
1901	567.0
1902	481.6
1903	422.9
1904	537.1
Average	500.0

These figures are based on the method of operating on the Mississippi River, the dredges being at work about one-third of the total time and tied up at the bank about two-thirds of the time.

The average rate of 500 cubic yards per hour can probably be counted on for twenty hours per day and twenty-five days per month, giving a total of 250,000 yards a month.

If the time consumed in placing plant, changing cuts, cleaning boilers, field repairs, and other work connected with dredging, exclusive of towing, plus an allowance of 10 per cent of the idle time for cleaning boilers and repairs, be taken as the working time the average output becomes 350 cubic yards per hour, which may be regarded as the average hourly rate that can be maintained for long periods of time in material such as is found in Mississippi River bars. This rate maintained hourly for a full month would give 252,000 yards per month.

The contract price of the *Harrod*, now under construction, complete with pipe line and all auxiliaries, is $238,998.17.

Its rated capacity, based on an estimated velocity of 22 feet per second in the discharge pipe and a carrying capacity of 10 per cent of sand, will be 2,100 cubic yards per hour.

The cost of operating the *Harrod* is estimated at $5,500 per month while in commission, assuming her to be operated under approximately the same conditions as the other Mississippi River Commission dredges.

In cutting channels through bars the dredges are so handled that the cuts are spaced 8 to 10 feet apart, the intervening ridges being leveled by the action of the current. To make a channel 250 feet wide requires an average of 6 cuts by the *Delta* (suction head 34 feet wide, 9 by the *Epsilon* and *Zeta* (suction head 20 feet wide), and 8 by the *Iota*, *Kappa*, and *Flad* (suction head 24 feet wide).

The depth of cut varies in different cases from 2 to 10 feet, 4 feet being a fair average.

For a 4-foot cut the excavation of a channel 1,000 feet in length involves the removal of 34,000 cubic yards by the dredge. Based on an average capacity of 250,000 yards per month this would give about 7,350 feet of channel as the monthly capacity of 1 dredge. This takes no account of time consumed in towing from bar to bar.

If such towing be required or if the average depth of cut is much over 4 feet the figure must be reduced accordingly.

In actual service in the past four years the average performance of the 6 dredges above mentioned, counting all working time, including towing, has been at the rate of about 7,500 feet of channel per month, the average depth of cut being 4 feet. Owing to the necessary stoppages for cleaning boilers and making repairs, however, this rate can not be kept up for an entire month. A reduction of about 12 per cent should be made for these contingencies, giving 6,600 feet as the average length of bar formation per month through which one of these dredges can open channels 250 feet wide, 9 feet deep, under the conditions of Mississippi river dredging.

The season for 1904 lasted four months, which would give 26,400 feet of bar or about 5 miles as the season's limit for one dredge.

From a study of the first three tables above it will be seen that the first cost, repairs and renewals, and operating in the field is less for a self-propelling plant than for a nonself-propelling plant.

The degree of efficiency with which dredges can be operated will depend a great deal upon the judgment of the engineer in local charge in selecting sites for the cuts and his skill in working the dredges to the best advantage.

Should a study of the bars as to their material show a preponderance of gravel or gravel mixed with clay or tough silt it may be necessary to change the design of the cutters for the dredges and this may result in greater first cost and less speed in cutting channels.

On the Mississippi River during the low-water season of 1904 four months and nine days' dredging was done on 17 bars lying in a length of 283 miles of river. Low stages were reached early in the season and lasted until quite late and the number of hours spent in actual dredging was 30 per cent greater than in any previous year. Notwithstanding the large amount of work required, depths of 9 feet and over were maintained on all bars, except at President's Island, where at four different times depths of 8½ and 8 feet were recorded, this being a specially hard bar upon which the cutters had comparatively small effect. This work was done by 6 dredges.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

WASHINGTON, D. C., *October 18, 1907.*

GENERAL: The Board of Engineers for Rivers and Harbors has had under consideration the report of a Board of Engineers convened by Special Orders No. 17, War Department, Office of the Chief of Engineers, Washington, May 12, 1905, for the purpose of examining the Ohio River and reporting with reference to its canalization.

The Board held a public hearing at Pittsburg August 12, 1907, at which representatives of the various localities interested in the proposed improvement presented statements, which are appended, and from August 13 to 18, inclusive, made a personal inspection of the river from Pittsburg to Cairo.

The existing project for the improvement of the Ohio River provides for the regulation of the river channel by the closure of chutes, the contraction of the channel by wing dams and training walls, and excavation of shoals by dredging. Navigation around the falls at Louisville during low stages of the river is through a canal. At stages above 12.7 feet on the gauge vessels pass over the falls through Indiana chute which has been improved for the purpose, at a 12.7-foot stage the falls being sufficiently drowned out to admit of up-river navigation. There has been expended on the general improvement of the river to June 30, 1906, $6,696,333.76, and on improving and maintaining the Louisville and Portland Canal and Falls of the Ohio $3,906,258.90.

While it has been considered that the regulation of the river by wing dams and training walls can successfully secure a minimum navigable depth of 3 feet this result has not yet been accomplished with the funds expended and no estimate of the cost of completing the work has been submitted.

It was recognized at an early date that the movement of coal, which has heretofore been the principal item of commerce on the river, required a channel of a depth of at least 6 feet, a channel which it was considered impracticable to obtain by regulation, especially in the upper river where the slopes are steep and the minimum river discharge small (about 1,600 cubic feet per second). Congress has authorized the construction of 6 locks and movable dams immediately below Pittsburg which were originally designed to secure a low-water channel of 6 feet for a distance of 28.8 miles and it has recently authorized their enlargement so as to obtain a channel of 9 feet. It has also authorized the construction of locks and dams designed for 9 feet navigation so as to create pools in front of East Liverpool,

Steubenville, Marietta (the mouth of the Muskingum River), Point Pleasant (mouth of the Great Kanawha River), Cincinnati, and above the falls at Louisville.

There was appropriated for these various works prior to the river and harbor act of March 2, 1907, $9,281,376.

In the report under consideration it is recommended that a series of locks and movable dams, 54 in number, be constructed between Pittsburg and Cairo of such height as to insure a depth of channel of 9 feet at all stages of the river, the locks to have a length of 600 feet and width of 110 feet. The Louisville and Portland Canal is also to be enlarged and an additional lock constructed 85 feet in width and 600 feet in length. The estimated cost of the work in addition to funds appropriated and authorized for lock and dam construction on the Ohio River prior to the act of March 2, 1907, is $63,731,488. The estimated annual cost of maintenance is $15,000 per lock and dam.

There is discussed a project for obtaining a navigable channel of 6 feet depth with similar locks and dams. The locks would be 45 in number, 5 less than heretofore proposed, and the estimated cost $50,962,266 in addition to funds heretofore appropriated and authorized. There is also discussed the practicability of obtaining and maintaining by dredging navigable channels of 6 and 9 feet depth from the mouth of the Green River to Cairo and the opinion is expressed that an increased depth up to 6 feet can be maintained by dredges from the mouth of the Green River to Cairo, but that it is not economically practicable by dredges to maintain a 9-foot depth over this stretch of river.

There is presented in the report a statement of the commerce of the river (Table 1, page 40) prepared by the Ohio Valley Improvement Association which gives receipts and shipments of the various towns along the river in 1905, amounting to 13,955,918 tons. A table (No. 3, page 48) is also submitted of the movement of freight at the mouths of the various tributaries of the river, amounting to 7,474,615 tons. The sum of these figures does not, however, represent the freight movement as these tables contain numerous duplications, an article shipped at one locality being reported as received at another, and Table 1 apparently giving as shipments and receipts at Pittsburg and vicinity the same items which appear in Table 3 as passing the Davis Island Dam, and at Paducah in Table 1 the movement in the Tennessee River given in Table 3.

The sum of the receipts in Table 1 amounts to 7,069,362 tons and of shipments to 6,645,056 tons, the tonnage of Wheeling amounting to 241,500 tons not being classified. Deducting the tonnage passing Davis Island Dam and moving at the mouth of the Tennessee River from the amount of tonnage reported in Table 3 there remains a tonnage of 2,532,627 entering and departing from the tributaries which has not been included in Table 1.

It appears from the reports of the Chief of Engineers that of this amount about 2,300,000 tons is coal, logs, and other timber products. There also moves on the Mississippi between Cairo and Memphis about 2,057,051 tons of coal, logs, and timber products and 161,312 tons of other articles, some of which come from the Upper Mississippi. The reports do not state whether the movement of these products

is into or out of the rivers. Coal, logs, and timber products, however, generally move downstream, and if the relatively small amount of freight composing other products be assumed as moving upstream the resultant error in computing the freight traffic on the Ohio will be slight. Under these assumptions there were received at the various towns on the river and moved out of the various tributaries and down the Mississippi about 9,359,040 tons of freight, and sent from the various towns and moved into the river from the Mississippi and the various tributaries 9,347,868 tons, indicating a freight movement on the Ohio of about 9,350,000 tons.

A large proportion of this commerce is coal. Of the freight reported as passing through the Davis Island Dam, 91 per cent consists of this product; through the Louisville and Portland Canal and over the Falls of the Ohio at Louisville, 92 per cent. This coal is loaded in barges drawing from 5½ to 8½ feet, and at low water is stored in certain pools until a rise of the river affords sufficient depth to enable the barges to float over the river shoals when they are guided down the river in large fleets by a single steamboat.

This method of transportation affords a very cheap means of handling freight, much cheaper than usually obtains on improved rivers and canals. It has been reported to the Board that coal has been shipped from Pittsburg to New Orleans at a rate less than 0.4 of a mill per ton-mile, a rate the same as that charged at present on coal shipped on the 20-foot waterway between Buffalo and Duluth where it is taken as a return cargo, the charge on iron ore from Duluth to Buffalo being at about twice that rate. The only instances known to the Board of cheaper rates are on ocean vessels of deep draft moving over long distances.

The project submitted in the report is designed so as to interfere with this method of transportation as little as practicable. A wide navigation pass is constructed in the dams which can be lowered whenever a rise occurs and leave an unobstructed river through which coal fleets can be moved as at present and the locks have been given such dimensions that when the dams are raised the smaller coal fleets which now navigate the river can pass through them without breaking tow. It makes provision for an enormous commerce, as it is estimated that 20,000 tons can be locked from one pool to another in one and a half hours, or at the rate of about 100,000,000 tons in one direction per annum even if the dams are not lowered.

The practicability of the proposed system of locks and dams has been thoroughly tested at Davis Island, 4.7 miles below Pittsburg, where a lock and dam of a similar character have been in operation since 1885, and the estimates of the cost of the work submitted are based upon experience acquired in the construction of that work and the other locks and dams which have been authorized by Congress.

As to the estimate submitted for annual maintenance, $15,000 per lock and dam, the Board notes that the average annual expenditure for maintenance both at the Davis Island Dam and at the Louisville and Portland Canal has largely exceeded these figures. The estimate, moreover, only includes the salaries of the lock force and the cost of repairs and renewals and no allowance is made for dredging in the pools.

The regimen of the Ohio River, especially as regards the character of the banks and the nature of the bottom, changes at or near the

mouth of the Green River, and below this point the Ohio River approaches in its general characteristics much more closely to that of the lower Mississippi.

The amount of material brought into the river by caving banks and of sediment pushed along the bottom is for this stretch of the Ohio River considerable and numerous sand bars are found. These sand bars build up during high water and are cut down during subsequent low water. If the river be improved by locks and movable dams the bar building will proceed during high water in practically the same manner as in the unimproved river, but the bar-cutting action of low water will be interfered with by the raising of the movable dams at the very time when this bar cutting is most active. It is probable, therefore, that the building of the bars during the high water and the cessation of the cutting during low water will have a tendency to gradually increase the size of the sand bars and the height of their crests and that in consequence the amount of the annual dredging necessary to maintain a navigable channel, even with a system of lock and movable dams, will in a few years be quite large. The Board is of the opinion that a liberal estimate for dredging should be made and places the cost of maintenance of the system at not less than $1,000,000 per year.

While a more economic system of improvement of the river could be devised than that submitted in the report by means of fixed dams and locks of dimensions more in accord with those usually adopted on rivers and canals, the Board is of the opinion that such a system would be such a hindrance to the existing coal trade as to preclude its use. The economy which results in handling coal in large fleets of barges will tend to preserve the existing method of transportation and even if the river were canalized as proposed it is believed that much of the coal transported would be moved as at present on rises and when the movable dams are down. Nor does the Board consider that the saving which would accrue to existing commerce by the proposed improvement would be sufficient to justify its cost. In fact, the losses claimed to be sustained by the coal interests due to delays in shipment under existing conditions are less than one-half the cost of maintaining the proposed waterway and it is believed that as much coal is now shipped by water as there is a demand for on the lower rivers. A material increase in the commerce of the river must therefore be created by the improvement and a change in the character of the freight carried to warrant such an expenditure. Nor is the Board prepared to indorse fully the views expressed as to the benefits to be derived from river transportation over that by rail. Railroads possess certain inherent advantages which compensate in great measure for the cheapness with which freight can be moved by water. The railroad companies have become the great agencies for transportation in this country. They have connected the principal towns with cheap lines of communication penetrating the field, the mine, the factory, and the warehouse. They have expended large sums in developing their terminal facilities in the various cities through which they pass and have erected elevators and other auxiliaries to reduce terminal charges. By consolidating into vast trunk lines the cars collected by the branches are moved long distances in train-load lots with great economy.

Lines of river transportation are restricted in location. They must follow the thalwegs of the larger valleys and can only penetrate a small part of the country. Except in the case of the comparatively few mines and factories which are situated on their banks it is necessary to transport by car or wagon from the shipping point to the waterways and then transship and reverse these operations to reach the terminal, while the railroad can ship from the mine to the factory or warehouse without breaking bulk.

Branch lines by rail or wagon are a necessity to an efficient water route. But in determining the cost of transportation by water the cost of these lateral feeders is not usually considered, while it forms a large percentage of the cost of rail transportation.

On the main lines of the various railway systems freight is being transported in train lots at a rate of less than two mills per ton-mile and it is natural for the railroads to endeavor to reap the benefits of a long haul and not surrender the most profitable portion of their trade to a rival water route. It would be unreasonable to expect them to act as feeders to a water route at a rate per ton-mile the same as they now charge for carrying freight from New Orleans to Pittsburg in competition with it, nor can they be compelled to turn over to rival carriers their warehouses, elevators, and other terminal facilities which they have erected at great expense.

Distances by rail are considerably shorter than by river, which compensates to a certain extent for their greater rate per ton-mile. A short water route can not successfully compete with a great railway system for through commerce. To be a success it must be of such a length that the great transportation companies will themselves find it advantageous to ship over it.

The waterways connecting the Great Lakes have enormously developed in the past ten years but the railways have reaped the benefits. Neither the Canadian canals down the St. Lawrence River, nor the Erie Canal across New York State have responded to the growth of the lake commerce. The success of the Great Lakes as a means of transportation has not resulted from competition between the great systems of transportation and outside parties but from the utilization of the waterway by the railroads themselves, which have expended millions of dollars to improve their terminal facilities and have established the large fleets which navigate the lakes.

But the great cause of the failure of waterways as a means of transportation in the United States is that they heretofore have not generally followed a commercial route but have led from nowhere to noplace. The river systems of the country flow generally in a southerly direction while the trend of commerce has been east and west. Until within the last ten years a railroad running north and south was generally a financial failure. River systems have followed the same laws, their commerce has been confined to the products on their immediate banks, and that of not sufficient amount to justify their permanent improvement. That great waterway, the Mississippi River, has been improved by the General Government and is now being maintained from New Orleans to Cairo at the depth proposed for the Ohio and for several years has been maintained from Cairo to St. Louis at a depth of 8 feet, yet its commerce is insignificant except what it receives from the unimproved Ohio. The river commerce of St. Louis has declined from 812,185 tons in 1895 to 370,425

tons in 1905, notwithstanding the enormous commercial growth of the city in other directions. The recent railway development from the grain center at Kansas City to the Gulf has diverted a considerable barge commerce from the river to railroad lines by a reduction in rates that the river improvement could not meet.

The Board, however, is of the opinion that conditions are exceptionally favorable for the future development of commerce on the Ohio River. The river now maintains a traffic of over 9,000,000 tons in competition with railways. This commerce appears to be slowly increasing and its growth appears principally in other products than coal.

Pittsburg is the center of vast manufacturing industries and is rapidly developing. Within the Pittsburg district are located 324 factories having water communication either by the Allegheny, Monongahela, or Ohio rivers, and which can as readily ship by water as by rail. The freight entering and departing from this district by river and rail in 1896 was estimated at 60,000,000 tons and in 1906 at from 115,000,000 to 122,000,000 tons. At Pittsburg among the principal manufactured articles are iron and steel ingots, billets, blooms, boilers, structural steel and iron, steel rails, and other material which at other localities become the raw material of their factories. Such items require cheap transportation and will seek a water route if assured of certainty of delivery. Large manufacturing centers also exist at Wheeling, Ironton, and other points on the river. Cincinnati, Louisville, and Evansville are business centers of great activity and a rapid commercial growth is occurring at St. Louis, Memphis, New Orleans, and other localities on the Mississippi River. The distances between these localities are sufficiently great to justify a transfer in transit even at considerable expense.

The Board believes that a large commerce is reasonably prospective if these commercial centers are connected by a waterway which will permit the certainty of transportation which is found on existing railroads and that this certainty will be attained by the works proposed in the report.

The General Government has expended large sums in improving the various tributaries of the Ohio. The utility of these improvements is dependent on the navigability of the main stream. The proposed improvement of the Ohio River will create a vast system of water communication penetrating one of the most populous and prosperous sections of the United States. Even in its unimproved condition the river has a marked effect on rail freight rates, the cheap rates quoted in the report as prevailing between New Orleans and Louisville, Cincinnati, and Pittsburg being directly traceable to its influence. Its effect on rail freight rates will be greatly increased if the proposed improvements are carried out.

For these reasons the Board is of the opinion that the improvement of the Ohio River by locks and movable dams so as to secure a depth of 9 feet as recommended in the report of the special board is worthy of being undertaken by the United States.

In making this recommendation the Board realizes that it is suggesting a plan for river improvement on a scale not hitherto attempted in this country, but it believes that there will probably be in the near future a popular demand for the improvement of several streams on such a scale. On account of the large commercial devel-

opment of its shores and its connection with the lower Mississippi now maintained in a navigable condition the Ohio River is, in the opinion of the Board, the one river of all others most likely to justify such work. Furthermore, it should be noted that by authorizing the construction for 9-foot navigation of 14 locks at various parts of the river Congress has already practically entered upon such a system of improvement.

Respectfully submitted.

H. M. ADAMS,
Colonel, Corps of Engineers.
CHAS. E. L. B. DAVIS,
Colonel, Corps of Engineers.
R. L. HOXIE,
Colonel, Corps of Engineers.
C. McD. TOWNSEND,
Lieut. Col., Corps of Engineers.
E. EVELETH WINSLOW,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

LETTER OF THE PITTSBURGH COAL EXCHANGE.

THE PITTSBURGH COAL EXCHANGE.
Pittsburg, Pa., August 9, 1907.

GENTLEMEN: In response to the invitation contained in your circular letter of July 1, 1907, asking for a statement of our views upon the commercial necessity for the improvement of the Ohio River we respectfully submit the following:

The subject naturally divides itself into two parts, first, a statement of present conditions on the Ohio River; second, expression of our best judgment as to future conditions when the river is improved to its highest efficiency.

PRESENT CONDITIONS.

The Ohio River has had certain local improvements made by the General Government which have proved of the greatest value in the way of furnishing harborage for river craft and certain places in the river such as the falls at Louisville, Ky., and other stretches of the river where navigation was very dangerous or impossible have been improved by dikes, dams, etc., but in so far as the heavy through commerce which can only be shipped on flood stages in the river is concerned the river is practically in its primitive and natural condition, barring of course, the exceptions mentioned above. The through commerce of the river at present consists of coal and general freight in barges. The bulk of the downstream freight at present consists of steel rails, cotton ties, wire nails, and other manufactures of iron and steel and general merchandise. The upstream freight in barges is mostly lumber, molasses, and sugar, while packets carry miscellaneous freight of all kinds and farm produce.

The uncertainty of making shipments of freight of this class on the Ohio River on account of infrequent stages in the river permitting such shipments is a sole bar to an immense business. The consignors of freight will hesitate before loading their wares when they have no guarantee that it will be shipped for months, even when the freight rate by water is greatly in their favor. The consignees, who in most cases want their orders to be filled by a certain date, will not risk shipment by a route so uncertain as to time of delivery. In addition to the uncertainty connected with shipping freight on a stream which depends for its navigable stages on such fortuitous circumstances as the happenings of nature the navigable stages prevail at a time when other natural conditions impose hardships, such as snow, ice, high winds, clouds, fog, and

floods of winter when an unimproved stream is deep enough to bear the commerce which would use it, while from say the 1st of May until snow flies in the late fall or early winter following, when other natural conditions are at their best and men could do the most work in a given time, the river is so low that idleness prevails almost this entire time in transportation business while freight accumulates and must be held in the Pittsburg Harbor at great expense.

In this connection we beg to quote part of an address delivered by Mr. John E. Shaw before the Merchants and Manufacturers Association.

"In June, 1895, there were collected in the Pittsburg Harbor 1,200,000 tons of coal loaded on about 2,500 vessels awaiting water to move down the Ohio River, the largest tonnage ever assembled in any harbor in the world at one time. The rise did not come until November 27. The cost of freight and vessels engaged in the service was estimated at $6,310,000. It cost $2,000 per day to keep the tonnage afloat and $1,000 per day interest on the investment, total $3,000 per day. This tonnage was kept waiting in Pittsburg Harbor for water in the Ohio River an average time of five months, or one hundred and fifty days at a loss of $450,000, which is 5 per cent on $9,000,000."

That such intolerable hardships and limitations should be imposed upon the commerce of the country, adding to the cost of commodities and causing a general stagnation in business with much property deteriorating in value without use, does not seem to be the wisest political economy. Even when the flood stage permits the shipment of freight downstream it subsides so quickly that before the freight can be delivered and other empty craft already unloaded at the point of delivery be returned the river falls to such a low stage that the ascending steamer with its tow of empty craft, which should be returned as soon as possible to the point originating the commerce, must go to the bank and wait for another stage in the river deep enough to permit it to resume its homeward journey. In a stream such as the Ohio where an immense through tonnage originates and is waiting at or above the very headwaters of the river, the natural and logical order for the improvement of that river would be to begin at its head and proceed down the river. The slope of all rivers is declivous near the watersheds and erosion has cut out pools and left shallows. It is this portion of the river that has the fewest days in the year when navigable stages prevail. Therefore common sense suggests that this part should receive attention at the hands of the Government first so the periods of through navigation may be prolonged, especially when the through commerce is of such volume and of such vital necessity to the welfare of so many people both on the borders of the streams and in remote places in this and other lands.

We would respectfully call your attention to the necessity for a comprehensive scheme for the improvement of the river at the falls at Louisville, Ky. The old proverb that a chain is no stronger than its weakest link applies with full force when used to illustrate the capacity of the Ohio River for accommodating through commerce as limited by the restrictions and scant facilities, speaking in a larger sense, afforded at the falls. Unless steamboats with tows reach the falls when there is falls water they must go through the slow and laborious process of locking their craft through the canal, and delay in breaking up their tows, stringing them out to pass them through the long canal, then through the locks and down the Ohio River to a place of assemblage again places an additional heavy tax on transportation. Far be it from our purpose to attempt to minimize the value to commerce of the Louisville and Portland Canal, and we shall not forget the debt of gratitude we owe the General Government for taking over this improvement and maintaining it in a high state of efficiency. It answered a great purpose when the commerce of the river was in its infancy, but we pass to larger things along all lines and the present, not to mention the future, is pressing upon us with larger demands and greater necessities, and the logical following out of our destiny will not permit us to do less than meet these demands and provide for these necessities. The old canal and river improvements were the concrete forms which old sentiments and old ideas took, fit type of their day, but the new sentiment with immeasurable volume and irresistible force and the new ideas with the cumulative addition of all past knowledge presenting a solution of all questions connected with the improvement here needed will carry out any recommendation which your Board may see fit to make. We therefore ask that you plan largely and comprehensively to meet the conditions which under the second division of this subject we attempt to show will prevail.

FUTURE CONDITIONS.

Every radical change of method must pass through an experimental stage, in which theory gives way to practice. This will be the case in the transition from the use of an unimproved stream, with all the handicaps, drawbacks, menaces, hazards, and dangers enumerated under present conditions to the use of an unimproved river with continuous or almost continuous navigation, but we apprehend that there will be abundant time to make the adaptation between theory and practice before the last link in the chain of river improvements is completed. We do not say this is in any sense forejudging that there will be delay in completing the improvement, but with a full realization of the stupendous task in mind we state it as a sound premise of a logical argument intended to show that we shall ship coal for many years yet under conditions very much like the present, except that the shipping times will be prolonged on account of the assemblage ground for tows moving down the river with the improvement where a longer boating season prevails, but general conditions will remain very much the same for years, so that we are safer in holding fast to present arguments founded on facts and past experience than in attempting to build argument on suppositions of the future. The project of improving the Ohio River by constructing locks and dams to provide a permanent stage in the river of not less than 9 feet is one that is commendable in the highest degree.

Just as the rain that falls on the hundreds of thousands of square miles of territory of the Ohio Valley finds its way at last to the great river so must nearly all the great bulky products of farm, mine, and mill within its confines that are not needed for local use find their way to it to be moved up or down as need may require, and to this must be added the commerce from other connecting sources.

The proper industrial development of the United States is in a large measure dependent upon the utilizing of the Ohio River to its greatest commercial capacity. To get the greatest good from river improvements they must be on a basis or scale that will permit of the largest use that their capacity may be made to serve, so that craft carrying the maximum tonnage and in the maximum assemblage that limitations other than those of the improved waterways prescribe may be used to keep the tax imposed by transportation to a minimum; in other words, the improved stream should provide a channel capable of bearing the largest commerce that the ingenuity of man in other fields may be able to place thereon. Anything less than this would cripple the stream, would prevent the reduction of transportation charges to the lowest level, and would be giving less than a sovereign people is entitled to or may demand; therefore, at least 9-foot navigation should be provided on the Ohio River.

The cheap transportation by water of the bulky raw material will permit, for instance, coal and cotton or coal and ore to meet anywhere along the route at mill or factory to turn out the finished product. The finished product will stand a higher freight rate than the raw material, and while freight on railroads will no doubt be lowered to compete with the cheaper water haul, still enough finished product will be turned out to tax the carrying capacity of the railroads at remunerative rates, so that river and rail will be reciprocal in their helpfulness.

To establish the fact still more strongly that the improvement of the Ohio River is absolutely necessary in order to furnish an outlet of unlimited capacity for waiting freight, attention is called to the chronic condition of freight congestion on all railroads, and in this connection there is no better authority than James J. Hill, the great railroad magnate of the West and Northwest, who, in a speech delivered in Chicago on November 11, 1906, said, in part:

"In the past ten years the growth in ton mileage was 110 per cent. The growth in the mileage of railroads to handle that traffic was 20 per cent. The traffic of the country is congested beyond imagination. The commerce of the country is paralyzed, and continued it means slow death. It is estimated that from 115,000 to 120,000 miles of track must be built at once to take care of this business. It will cost from $4,000,000,000 to $5,000,000,000—a thousand million of dollars a year for five years will suffice. Why, there is not enough money or rails in all the world to do this thing. And if the rails were piled up ready for the undertaking and if the money were in bank to-day it would be impossible to get the labor with which to do it. Freight cars only average two hours a day in operation."

And when we consider the commerce of the country is increasing by great leaps and bounds we find commerce has already far overlapped the facilities for

handling it. Where freight is proffered instead of being sought, the carrier will not be so considerate in fixing the rate.

That usable thing, for whose use necessity exists, whose use is free to all, will always be popular in any country and especially when in it the masses find relief and protection from the exactions of utilities controlled by private interests and monopolized for private gain. The benefits which seem to come to a special interest where local river and harbor improvements are made are in a measure equalized over extensive areas and shared by the last man in the line when such improved waterways become connected and general.

River business under proper conditions is susceptible of enormous expansion and this expansion must come with increased demand. The simple multiplication of people multiplies demand. "Teeming millions" is a favorite expression of speaker and writer on river improvements when speaking of the future population of the Ohio Valley and it is not hyperbole. The most careless look into the future reveals an enormous population there is to be served. All past experience teaches that congested centers of population are only possible near waterways of some kind or other. Given slackwater on the Ohio River and the hamlet blends with the village, the village with the town, the town with the city, until overlapping enlarged borders cover up the lines of sections and one social and commercial empire comes into existence. This development can, however, only take place after continuous water communication is established. When used in connection with navigation the word "continuous" is one to conjure with. It is the one essential element of future development.

There was a time when the farmer brought the doctor and shoemaker and after long intervals a few other artisans straggled in, but a waterway affording continuous navigation brings a mill and 3,000 men to run it; 5,000 houses to shelter them and their families and those of other walks of life and we have a city in a day. Events too recent to be history illustrate this without argument. A single example—Midland, Pa., about 37 miles below Pittsburg, on the Ohio River. Two years ago an apple orchard, to-day, 2 square miles of coke ovens, furnaces, and steel mills with yardage, using 6,500,000 bushels of coal a year, with a maximum consumption contemplated of many times that much.

With or without the Isthmian Canal we anticipate an accelerated development of all countries to the southward of the United States. Coincident with this development should be our preparedness to supply that which such development may need. The railroads of the country have not the facilities for handling these supplies. If they could increase their handling capacity many times over, the freight rate to such distant points would be prohibitive, so that the improvement of the Ohio River at the earliest date possible and to its fullest capacity is the imperative necessity of the hour. The world-wide movements of commerce, so general and so easy along water routes, demand it.

Respectfully submitted.

J. FRANK TILLEY, *Secretary.*

BOARD OF UNITED STATES ENGINEER OFFICERS FOR RIVERS AND HARBORS,
Pittsburg, Pa.

LETTER OF H. D. W. ENGLISH.

MANOIR RICHELIEU,
POINTE À PIC, QUEBEC,
August 9, 1907.

My DEAR CAPTAIN RODGERS: It is with the keenest regret I find I can not be with your committee at this time and at the hearing of the Government engineers on the 12th.

The proposition to deepen the river channel is of vital importance to one of the richest and most populous sections of the United States, and a section that contributes much to the Government, aside from the great commercial value of this improvement to millions of people in the many States which would be benefited, it is of vital importance to the Government itself.

The United States has been slow to see the value of a definite and constant stage of water with the greatest workshop it has and the sea. As the Panama Canal progresses and the need of greater protection to the Pacific coast is made imperative, and indeed that condition now exists, it will be emphasized how very necessary it is to have uninterrupted intercourse with the workshop where the Government must come for its heavy supplies in time of need. No

better means of transportation than water can be had for just such heavy tonnage.

Irrespective of the great aid to commerce, and there is no improvement presented to the Government to-day, which means so much to the commerce of this country, it seems to me it is a patriotic duty that the Government owes to the whole country to see that its greatest stronghold in time of stress is of easy access for its own need.

It therefore becomes a national duty and this question is one which affects the whole country. It would seem to me the Government engineers, whose pleasure it is for the chamber of commerce to entertain, realizing the great part played by this city in our last two wars, would readily see the force of the proposition to keep an accessible waterway to the "workshop of the world."

I regret that my absence makes it impossible to assist you in entertaining the Government engineers and emphasizing the great importance from every reasonable standpoint this great improvement would mean to the country commercially and as a future safeguard and defense.

It is important that every interest be represented at this hearing and I hope the efforts of the committee on rivers and harbors of the chamber of commerce to awaken the individual citizens of Pittsburg will meet with the success your earnestness in this cause deserves.

With kindest personal regards, faithfully yours,

H. D. W. ENGLISH, *President.*

Capt. W. B. RODGERS,
Chairman, Rivers and Harbors Committee,
Pittsburg Chamber of Commerce.

LETTER OF THE CINCINNATI INDUSTRIAL BUREAU.

CINCINNATI, *August 10, 1907.*

GENTLEMEN: On behalf of the industrial interests in particular and the commercial interests in general of Cincinnati and vicinity, we beg to submit herewith for your consideration certain statements regarding the importance to those interests of the early completion of the improvement of the Ohio River to a permanent 9-foot stage.

Cincinnati is essentially a manufacturing and distributing center. The value of the manufactured products of the factories of the city is greater in proportion to population than that of any other city in the country. It may be said with equal truth that a larger percentage of its citizens is interested in manufacturing, either as employer or employee, than in any city of equal size. Careful estimates, based upon the best statistics obtainable, place the value of Cincinnati manufactured products in 1906 at $400,000,000.

Owing to its centralness of location with respect both to the Ohio Valley and to the population of the country, Cincinnati is the distributing point for a large and thickly populated territory, in which originate and to which are shipped the widest range of raw material and manufactured articles, mineral and agricultural products.

More articles for the export trade originate in Cincinnati than in any other inland city, and it is no exaggeration to say that because of the remarkable diversity of manufacturing in this city, Cincinnati-made goods are to be found in every market of the world.

These facts are stated for the purpose of emphasizing how vital to Cincinnati and vicinity is the matter of transportation, for it is self-evident that upon the facilities and the economies of transportation depend the future of the manufacturing and commercial interests of the city.

The foundation for Cincinnati's greatness as an industrial and commercial center was laid in the days when the waterways were the principal arteries of commerce and when steamboating was at its zenith on the Ohio River. With the advent of railroads the city became one of the chief railroad centers of the country.

Developments of the past few years have proved the inadequacy of the existing railroads to care for the wonderful growth of business of the country generally, and this condition applies with equal force to Cincinnati and vicinity. Uncertain as river transportation is and has been for years on the Ohio River,

the business interests of Cincinnati have therefore not failed to appreciate the great benefits that even such uncertain river transportation has been to the city of Cincinnati.

Notwithstanding the frequent and often lengthy interruptions to transportation from low water and other causes, the presence of the Ohio River and its influence upon transportation rates to and from the city have given to the manufacturer and the merchant an advantage not enjoyed by the business interests of other cities not similarly situated.

In its present condition, the river is and has been of great service further in bringing to Cincinnati her supply of coal and timber by a mode of transportation which is the cheapest known to man.

Recognizing, then, the benefits of the Ohio River in its present condition, we submit that the great interests of Cincinnati which we represent are in a position to appreciate to the fullest extent the benefits which must accrue from the early permanent improvement of the stream, and may be permitted to urge for the consideration of your honorable board the completion of the improvement of the Ohio on a basis of a 9-foot stage at the earliest period consistent with good practice and substantial results.

The importance of Cincinnati's export trade leads the industrial interests of Cincinnati to ask that special efforts be made to have the Ohio River improvement completed, at least simultaneously with the completion of the Panama Canal, so that the producers of Cincinnati and the Ohio Valley may be in a position to compete on equal terms with those sections already enjoying an all-water rate to the markets of the world.

To all of which we respectfully ask your special attention and court your most careful and favorable consideration.

THE CINCINNATI INDUSTRIAL BUREAU,
WM. LODGE, *President*,
WILL L. FINCH, *Secretary*.

To the BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

LETTER OF THE AMERICAN ASSOCIATION OF MASTERS AND PILOTS OF STEAM VESSELS.

AMERICAN ASSOCIATION OF MASTERS AND PILOTS OF STEAM VESSELS,
Pittsburg, Pa., August 10, 1907.

At a special meeting of Pittsburg Harbor No. 25 of the American Association of Masters and Pilots, representing 200 licensed steamboat officers navigating on the Monongahela, Allegheny, Ohio, Great Kanawha, and Mississippi rivers, the following resolution was unanimously adopted:

"*Resolved:* That we favor the improvement of the Ohio River from Pittsburg to Cairo by providing for a 9-foot channel by the lock and dam system, believing that it will result in inestimable value to all business interests of these great valleys."

Very respectfully submitted.

P. W. BOLL, *President*.
A. R. MACKEY, *Secretary*.

The BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
IN SESSION, PITTSBURG, PA.

LETTER OF THE CINCINNATI (OHIO) CHAMBER OF COMMERCE AND MERCHANTS' EXCHANGE.

CINCINNATI CHAMBER OF COMMERCE AND MERCHANTS' EXCHANGE.
Cincinnati, August 10, 1907.

GENTLEMEN: In connection with having a representative of the Cincinnati Chamber of Commerce appear before your body at its hearing concerning questions relating to the improvement of the Ohio River, it is presumed to be proper to submit something of written declaration calculated to impress you with the great interest which the people of our community have in the work that has been urged to be done upon this great waterway, work which in promoting the industrial interests of this particular locality will correspondingly promote the interests and industrial development of a vast region of the

very best part of our country, in its command of available resources for agricultural, mineral, and timber products, which represent the food and fuel requirements and the raw material which constitute a great part of those things called for in the application of industrial enterprise, encouraged by financial investment, in the development and utilization of such resources. It is no dream, but a plainly demonstrable proposition, that such a betterment of the natural advantages here commanded in this waterway as has been asked of the Government will yield for more than a commensurate return to the Government in results which count for reimbursement to the national interests for application of public funds. We do not feel that you need assurance from us of the merit of such views. We do not feel that we are called upon to now specialize the benefits which will follow the accomplishment of provisions for a 9-foot stage of the Ohio River, and the naturally incidental improvement of the Mississippi River, all without undue delay in progress of constructive work, making it possible that the industries and commerce of this region will be prepared to command a full share of the benefits belonging to it in connection with the great advantage looked for as resulting from the completion of the Panama Canal.

In submitting these expressions with our greetings to your honorable body, we do so in fullness of conviction that the greatness of the work you have in hand and its power for promoting the good of the country is thoroughly understood on your part—our action now being taken under the desire to maintain our claims for recognition as among those who are keenly concerned in your labors, as we have been in such efforts in the past and must be expected to be in the years to follow.

Most sincerely yours,

W. A. BENNETT, *President.*
C. B. MURRAY, *Executive Secretary.*

To the BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
IN SESSION AT PITTSBURG, PA.

LETTER OF THE OHIO VALLEY IMPROVEMENT ASSOCIATION.

CINCINNATI, OHIO, *August 10, 1907.*

GENTLEMEN: The Ohio Valley Improvement Association, representing now, as it has for the past twelve years, commercial, manufacturing, and all kindred organizations, firms, corporations and individuals, in every city, town, and hamlet situated on the Ohio River from Pittsburg to Cairo, all vitally interested in, and strongly advocating the improvement of the river, submits for the consideration of your honorable Board the following reasons why the Ohio River should be permanently improved on a 9-foot basis:

The Ohio River drains the greatest freight-producing section of the Union. In its valley lies both the center of population and the center of the manufacturing industry of the United States.

The river in its unimproved condition and confessedly with most uncertain navigation carries more freight than any unimproved river in this country or in the world. Its present tonnage is now greater than the Mississippi and all of its other tributaries combined. These conditions together with the geographical location considered we earnestly believe and confidently state that within the first year of the completion of the improvements, the present tonnage of the river would double and quadruple within a decade.

Nine feet is advocated and urged for the reason that years of experience by the heavy carriers of cargo on the river has demonstrated that to be the most economical depth. On 9 feet the heavy products of the valley can be moved effectively and cheaply.

Nine feet will open up to the manufacturers and producers of all sections of the valley a cheap and reliable all-water route via New Orleans and the Panama Canal to the markets of the world.

Nine feet is further advocated and urged for the reason that the United States Engineer Corps has stated that the same depth can be secured and maintained in the Mississippi River from Cairo to its mouth at all seasons of the year by dredging and at slight cost.

Rate regulation.—The permanent improvement of the river so that its navigation would be continuous and dependable alike for the shipper, the receiver,

and the carrier, would make it a regulator of rates throughout every section of the entire valley.

In concluding this brief argument we desire to respectfully and earnestly call your attention to the fact that until the entire system of locks and movable dams (to which plan of improvement the General Government, by and with the approval of the United States Engineer Corps, is now firmly and irrevocably committed) is completed throughout the entire length of the river, it will only serve in part the commerce that is now anxiously awaiting these improvements, and unless the permanent improvement of the Ohio River is made effective coincident with the completion of the Panama Canal, the 6 great States bordering the river, who will pay a larger percentage of the cost of that canal than any other of like number in the Union, will be deprived to a very great extent of their prorata benefit therefrom, in consideration of which the Ohio Valley Improvement Association asks at your hands such a recommendation, through the Secretary of War, to Congress, as will tend to the more rapid and business-like completion of the work.

All of which we respectfully submit.

OHIO VALLEY IMPROVEMENT ASSOCIATION,
Per JOHN L. VANCE, *President.*
J. F. ELLISON, *Secretary.*

To the BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

SUPPLEMENTAL STATEMENT OF THE OHIO VALLEY IMPROVEMENT ASSOCIATION.

The permanent improvement of the Ohio River to a depth of 9 feet means more than the advancement of the interests of the people of the valley; it means—

First. That an equal benefit will be given to the manufacturing, commercial, mining, agricultural, and all other and varied interests of the people dwelling along the tributaries of the Ohio, the Monongahela, Allegheny, Beaver, Muskingum, Little Kanawha, Big Kanawha, Big Sandy, Licking, Kentucky, Green, Cumberland, Tennessee, and Wabash; and embracing 3,300 miles of navigable water, which added to the Ohio gives a grand total of about 4,300 miles, which may be properly called the Ohio River system. Many of these tributary streams have been improved or are in process of improvement by the General Government. With but few exceptions these improvements do not and can not be expected to serve the purpose intended with the Ohio unimproved.

Second. That vast incalculable benefit will accrue directly to the lower Mississippi Valley (and indirectly to the upper Mississippi), and to the tributaries of the Mississippi. Memphis and New Orleans will be benefited as much as Pittsburg and Cincinnati in proportion to the interests involved.

Third. The development of the boundless resources of the Ohio and its tributaries now lying dormant for want of means of transportation.

Fourth. That Pittsburg, now the greatest manufacturing center in this country or in the world would increase its factories and its product and the factories at other points and they cover the country from Pittsburg to Cairo, would grow in number and capacity until to use the language of a prominent officer of the Engineer Corps "the Ohio Valley will become the workshop of the world."

Fifth. That we shall witness no freight congestion in the basin of the great inland waterway systems of the Ohio and the Mississippi.

Sixth. That freight rates will be regulated, not alone along the Ohio and tributary territory, but throughout the lower Mississippi Valley. The truth of this statement has been demonstrated on the Ohio even in its unimproved condition.

Seventh. That the business which will be given the Isthmian Canal will justify the expenditure necessary to build it. The products of the factories of Pittsburg and the Ohio Valley are now found in all the markets of the world, but trade has been and is hampered and shackled by want of transportation. With the Ohio improved the products of the valley will reach without bar the markets of South America, the Pacific ports, and the Orient by way of the Ohio and the Mississippi rivers. Barges may be loaded at Pittsburg and not break bulk until their destination is reached, whether this be in South America or at ports of the Pacific.

Eighth. That freight will be carried with greater regularity and at greater speed, matters of paramount importance to all interests.

Ninth. That the growth of business, and consequently tonnage will equal if not surpass that which has followed and was made possible by the improvement of the Sault Ste. Marie Canal, and it practically assures the connection by canal of Lake Erie and the Ohio at the upper end of the river.

LETTER OF THE MANUFACTURERS' ASSOCIATION OF BEAVER COUNTY, PA.

Beaver Falls, Pa., August 12, 1907.

DEAR SIRS: At a meeting of the Manufacturers' Association of Beaver County, held August 10, 1907, it was unanimously resolved that T. L. Kennedy, James W. Brown, E. L. Hutchinson, S. P. White, and C. C. Hagen be a committee to represent the association before your committee, to present the following memorial and to answer any questions your honorable body may care to ask:

MEMORIAL.

The members of the Manufacturers' Association of Beaver County, an organization embracing the entire manufacturing interests in Beaver County along the Ohio and Beaver rivers, a frontage of about 45 miles almost entirely occupied by iron, steel, and other manufacturing plants, and operators in the sandstone, limestone, clay, and coal deposits, desire to call the attention of your honorable body to the vital importance of the improvement of the Ohio River by making a 9-foot stage of water from Pittsburg to Cairo.

When we take into consideration the fact that the tonnage of what is known as the "Pittsburg district," of which we are a part, exceeds the combined tonnage of New York, Chicago, Philadelphia, and London, England, the absolute necessity for utilizing our natural waterways as a mode of transportation becomes apparent.

The railroads have been utterly unable to handle the tonnage that has been offered them. For long periods some of the largest shippers have had their business curtailed from 40 to 60 per cent on account of the railroads being unable to move their freight. That you may know of the class of our industries we will enumerate some of them: The Jones & Laughlin Steel Co., the largest independent steel company in America, if not in the world, are erecting a new plant that covers over 3 miles of river front, at an expenditure of nearly $30,000,000: the American Bridge Company on the east side of the river has the largest bridge and structural steel plant in the world, and when an adequate stage of water is assured they will have the largest steel boat yards in this country; the Colonial Steel Company, the largest independent cut crucible steel works in the country, have their plant on the west side of the river; the Midland Steel Company have their plant located between Locks Nos. 6 and 7. These works have been erected at a cost of about $15,000,000. The H. K. Porter Locomotive Works, the best known manufacturers of narrow-gauge locomotives, are building a new plant on the banks of the Ohio, adjoining the American Bridge Company; the largest tumbler works in the United States is situated near Lock No. 5.

In addition to the above, there are a great many industries whose tonnage is very large and who have been badly handicapped on account of inadequate shipping facilities. Take the clay industries alone; there are over twenty brick manufacturers whose output exceeds 3,000,000 tons annually of manufactured brick and in addition ship thousands of tons of fire clay.

By making the improvements asked it will enable our manufacturers to enlarge their plants and expand their business. There is no encouragement to do this now as the railroads can not handle the present output.

The Beaver River which drains the great valley of the same name enters the Ohio at Rochester. Its banks are lined with manufacturers of all kinds which would ship largely by water if possible.

It is up this stream that a company is now preparing to build the Lake Erie and Ohio River Ship Canal to the Great Lakes.

It is estimated that along this canal between the Ohio River and the Lakes the annual tonnage is 30,000,000. This includes the large towns of Beaver, Rochester, Bridgewater, New Brighton, Fallston, Beaver Falls, Wampum, Ellwood, New Castle, Sharon, and South Sharon, all in Pennsylvania; Youngstown,

Struthers, Warren, Niles, in Ohio, all of which are iron and limestone producing centers, making a heavy tonnage which could be better moved by water than by rail.

Beaver County abounds in sandstone quarries; Beaver County sandstone has been specified for Government work for many years, which is an evidence of its durability. Our quarries could supply enough stone to build all the locks and dams needed for a 9-foot stage from Pittsburg to Cairo.

We humbly pray your favorable consideration and action, not for the local benefits alone, but for the benefit of the Beaver Valley, the Ohio Valley, and the nation as a whole.

We have the honor to subscribe ourselves,

THE MANUFACTURERS' ASSOCIATION OF BEAVER COUNTY,
F. N. BEEGLE, *President*,
H. J. BOOTH, *Secretary*.

The BOARD OF UNITED STATES ENGINEERS COMMISSION FOR THE OHIO RIVER.

MEMORIAL OF THE PITTSBURG (PA.) CHAMBER OF COMMERCE.

[Presented by Hon. George W. Guthrie, mayor of the city of Pittsburg and member of the Chamber of Commerce.]

AUGUST 12, 1907.

The Chamber of Commerce of Pittsburg, representing more than 1,000 of the business men and manufacturers of the city and district would, in response to your circular letter of invitation of July 1, 1907, respectfully memorialize your honorable board in behalf of the improvement of the Ohio River throughout its entire length by means of locks and dams so as to secure at all times a minimum low-water depth of 9 feet.

The chamber of commerce has for many years been actively engaged in successful efforts to promote the improvement of the Ohio and its constituent streams, the Monongahela and Allegheny, and the experience thus gained has convinced its members of the absolute necessity for the proposed deepening of the river from Pittsburg to Cairo, and of the vast advantages which would accrue, not only to the people directly on its banks, but to those of the entire Mississippi Valley and of the nation generally, from the proposed improvement.

It is understood that your honorable body has in its possession full statistics heretofore furnished as to the traffic of the river and that it is not necessary now to refer to them in detail, the object of this memorial being to present an argument for the improvement of the Ohio upon the abundant evidence already adduced and that which is patent to every careful observer of industrial conditions in this district.

Although the Ohio River has had certain local improvements made by the Government at its head and also at a few points along its course where navigation is especially difficult and dangerous, yet in so far as the heavy through traffic, which can only be carried on at certain flood stages is concerned, it is, with these exceptions, in its primitive and natural condition. This fact and the uncertainty of the periods of available high water, of course, greatly militate against the growth of a regular through traffic.

The present through commerce of the river embraces coal, steel rails, cotton ties, nails and other manufactures of iron and steel, window glass, glassware and general merchandise carried downstream in barges and packets, and lumber, molasses, sugar, farm products, furniture, whisky, and a great variety of other freight carried upstream.

Despite the uncertainty of the periods of navigation, a large business is done on the Ohio.

It should be remarked that large as is the traffic now carried on the Ohio, its constituent streams, and its tributaries, it can only be taken as some indication of what the river business would amount to if instead of being carried on intermittently and at uncertain periods it could be pursued daily throughout the whole year.

In a letter written at Pittsburg, on March 19, 1904, by Capt. William L. Sibert, Board of Engineers, U. S. Army, and subsequently issued in pamphlet form, occurs the following:

"The coal and other barge traffic on the Ohio from Pittsburg has not grown materially for a number of years past, and it may be said, with much show

of truth, that it has reached the limit of economical investment of capital, i. e. to say it is handicapped with such irregularities in the seasons as to make the factor of profit a very uncertain quality. The boats crowd each other so closely in going out of Pittsburg on some of the short-lived freshets that it would not be safe to start more fleets, even if they were ready to go, and, naturally, always such great haste is made to return empty barges to Pittsburg before the river has fallen to too low a stage for the steamers, that little or no attempt is made to obtain upward-bound freight."

During the last few years, shipments of coal to New Orleans and other Mississippi ports from Pittsburg were much reduced because of the use of Beaumont, Tex., oil, but the exhaustion of the latter has lately caused a renewed demand for Pittsburg coal which must be shipped by river. The present condition of the river, however, makes it impossible for this district to properly supply the demand. Nothing but a 9-foot stage would suffice for this purpose.

It is entirely safe to assume that within a short time after a permanent 9-foot stage was provided in the Ohio from its head to its mouth, the present tonnage would be trebled or quadrupled.

That this result will be surely achieved will be evident from the fact that navigation is now possible from Pittsburg on an average of only about seventy-nine days in each year for craft of heavy draft, while with the proposed improvement it would be carried on for an average of three hundred and twenty days. Not only the increased period of operation, but the greater certainty would vastly promote shipments on the river.

The traffic on the Ohio River for the year 1906 is said to have been 11,427,784 tons, the bulk of which was downstream traffic. The number of passengers carried is said to have been 4,849,069. This statement is said to be very conservative.

For the year 1902, the traffic is said to have been 12,202,017 tons; for 1903, 12,499,842 tons; for 1904, 10,142,551 tons, and for 1905, 13,163,656 tons. These figures seem to indicate the large fluctuations in yearly traffic caused by high or low water.

It is claimed by some who are well informed on the subject that if complete and accurate data could be secured of the entire traffic on the Ohio and its tributaries, the total amount would reach not less than 20,000,000 tons.

It is an important fact that every improvement of the river and of its constituent streams and tributaries, the construction of each new lock and dam, has been followed by a substantial increase in the traffic.

The traffic on the Monongahela River for the year ending June 30, 1907, was 11,817,128 tons. Ten years ago, when the Government assumed control, the traffic was only about one-half this amount.

The traffic on the Allegheny River for the year ending June 30, 1907, was 2,583,757 tons, although there are only two locks and dams in operation on that stream. Ten years ago the traffic was only about one-fifth that amount.

The tributaries of the Ohio also steadily increased their traffic as improvements have been made upon them.

While the business on the Monongahela River, which enjoys permanent navigation throughout the year, amounted as we have seen during the last year to nearly 12,000,000 tons, and that on the Allegheny to over 2½ millions, only 3,346,347 tons passed below their mouths into the Ohio and through the Davis Island locks. Were the Ohio, however, deepened throughout its course to 9 feet there is no doubt that the growth of its through traffic would vie with and surpass the rate of the growth of business on the Monongahela and Allegheny. As proof of this it may be cited that whereas in July, 1906, because of low water, only 2,150 tons of freight passed Davis Island dam, during July, 1907, when navigation was almost continuous, 405,503 tons passed. This latter showing was also made although the rise was not anticipated and the coal sent down the river, amounting to over 300,000 tons, had to be mined and shipped in a hurry to take advantage of the navigable water.

In July, 1902, when high water was anticipated and it lasted all month 1,123,999 tons of freight passed Davis Island dam.

By the time the Ohio River can be improved throughout its length many additional improvements will have been made in its two great constituents and on its tributaries. It is probable also that it will have been connected by canals with the Great Lakes and the Hudson River and have become an important link of a great internal waterway extending from the Gulf of Mexico to New York and Boston on the east, to Quebec on the northeast, to Chicago

on the west, and to Duluth on the northwest. As such, its traffic upstream, as well as down, would undoubtedly soon vie in volume with that passing through the Sault Ste. Marie Canal and the Detroit River, which under the stimulus of repeated great improvements in navigation has been increased in a quarter of a century from about 2,000,000 tons to over 60,000,000 tons annually.

It is estimated that because of the new lock about being constructed for the Sault Ste. Marie Canal the traffic passing through the latter ten years hence will exceed 100,000,000 tons, much of which will be iron ore bound for steel industries on the Ohio River.

The opening of the Panama Canal will also have an important effect in stimulating traffic on an improved Ohio.

All experience shows that improved navigation creates new river business at a most rapid rate. It cheapens the price of raw materials and thus builds up large new industries. In 1886, the River Main, between Frankfort and Mayence, Germany, was deepened from 6 to 12 feet, despite the opposition of the railroads on its banks. Two years thereafter the river traffic had increased 100 per cent and the railroad traffic had been largely augmented. United States Consul-General Mason on December 10, 1897, also reported as to this matter, as follows:

"That the river traffic, which amounted to only 150,000 tons annually before the improvements were made, increased to 1,693,112 tons in 1896, while the traffic by rail, which amounted to 930,000 tons in 1886, increased to 1,639,229 tons in 1896, being almost double what it was 10 years before, when the railroads had a practical monopoly of the freight business of Frankfort."

It will be noted that the river business increased over 1,000 per cent in the 10 years after the navigation was improved.

Already great new industries are being established on the banks of that portion of the Ohio River just below Pittsburg, which is now being improved. Among these are the great new plants of the Jones & Laughlin Steel Co., the Midland Steel Company, the American Bridge Company, the Phoenix Glass Company, the Colonial Steel Company, and the Riter-Conley Manufacturing Company.

The tonnage of the Pittsburg district is increasing by leaps and bounds and has already reached mammoth proportions. Not including freight in transit it was estimated in 1906 at 122,000,000 tons. Vast as it is, and rapid as has been its increase, greater results could have been achieved had not the growth of the district's industries been greatly hampered by the lack of full transportation facilities by rail and water.

One of the largest coal companies in the world whose mining properties are situated in this district reports that it has been impossible to secure more than 70 per cent of the cars needed to accommodate the capacity of its mines now opened. As a result its output has been curtailed 30 per cent while the opening of new mines has been prevented.

The proposed improvement of the Ohio to Cairo and its connection with the Great Lakes would result in the great expansion of this and many other industries of the Pittsburg district and other sections connected by this waterway, the growth of which have been similarly hampered by the lack of proper transportation facilities.

The time has passed when we can afford to proceed at the same leisurely gait which we have thus far been taking in the matter of the improvement of our rivers and every year's delay in this work is costing the American people many millions of dollars. Our railroads by the confession of their chief owners are unable to deal properly with the traffic offered them. James J. Hill, president of the Great Northern Railroad, stated that in ten years while railroad building has increased only 21 per cent, business has increased 110 per cent and that it will require an expenditure of $5,500,000,000 by the railroads in five years to enable them to properly handle the business.

He further declared that a 15-foot canal from St. Louis to New Orleans would do more to relieve the entire Middle West and Southwest than any railroad that could be built.

We have no hesitation in declaring that the proposed improvement of the Ohio would afford as much or more relief to the businesses of the country generally.

President Roosevelt in his letter appointing the National Internal Waterways Commission, said:

"It is common knowledge that the railroads of the United States are unable to move crops and manufactures readily enough to secure the prompt trans-

action of the business of the nation, and there is small prospect of immediate relief. There appears to be but one complete remedy—the development of a complementary system of transportation by water. The present congestion affects chiefly the people of the Mississippi Valley and they demand relief. When the congestion of which they complain is relieved the whole nation will share the good results."

The improvement of the Ohio River will benefit the people of the Mississippi Valley and its good effects will be felt throughout the entire nation. It would be of vast importance in relieving the congestion of the railroads and in regulating their charges. It would expedite the movement of freight. Already, in times when the Ohio is navigable, freight is carried from Pittsburg to Cincinnati by boat more rapidly, as well as more cheaply, than by rail.

During the past few months frequent rains have permitted of almost continuous navigation on the rivers and as a result coal and all kinds of manufactured commodities and the products of the farm have been sent with great regularity to southern river points to the great advantage of the producer and the consumer.

The expenditure of about $50,000,000 within the next few years for the deepening of the Ohio would speedily yield a return of many fold that amount to the people of the nation, everyone of whom would be benefited by the increased prosperity and the decreased cost of commodities that would follow from the improvement and cheapening of transportation facilities thereby effected.

In the letter written by Capt. William L. Sibert, heretofore quoted, it is estimated that the cost of carrying 3,500,000 tons of coal from Pittsburg to Louisville, in the present state of the Ohio is 45.8 cents per ton and that if the river were permanently deepened to 9 feet, the cost would only be 24.1 cents per ton.

He further estimated that with the improved river the rate per ton from Louisville to New Orleans would be only 53.38 cents as against 89.2 cents at present, the saving would thus be 21.7 cents per ton from Pittsburg to Louisville and 35.82 cents more from Louisville to New Orleans.

If we assume that the average saving for all the present reported traffic of, say, 12,000,000 tons on the Ohio, which would be effected by its improvement to 9 feet, would be only 25 cents a ton, the total yearly amount saved would be $3,000,000. If the improvement caused only an increase of 3½ times the present reported traffic within a few years, the annual saving would be $10,000,000; so that in five years the total estimated cost of the improvement would be equalled. If however the cost of the improvement should be $100,000,000, it would only require ten years of improved navigation to save that amount. And this takes no account of the far greater saving which would be effected by carrying the increased amount of freight on the improved river at water transportation rates instead of by rail at railroad rates.

The expenditure of $6,900,000 by the Government for the freeing and improvement of the navigation of the Monongahela River is estimated to have saved the consumers of steel in the country generally about $4,000,000 a year.

The $68,000,000 expended by the Government for the improvement of the navigation of the Great Lakes is estimated to have saved the consumers of many staple products throughout the country about $139,000,000 annually.

We feel therefore that in asking the favorable action of your honorable board in the matter of the improvement of the Ohio that we are not pleading for Pittsburg and the district immediately tributary to it alone nor merely for the whole Ohio Valley but that we are advocating the interests of the entire Mississippi Valley and of the nation generally, for which interests we humbly pray your favorable action.

We have the honor to subscribe ourselves, dear sirs,

THE CHAMBER OF COMMERCE OF PITTSBURG,
H. D. W. ENGLISH, *President.*
[SEAL.] WM. B. RODGERS,
Chairman of the Rivers and Harbors Committee.

Attest:

JAS. W. WARDROP, *Secretary to Committee.*

The BOARD OF UNITED STATES ENGINEERS FOR THE OHIO RIVER.

MEMORIAL OF THE OAKLAND BOARD OF TRADE, PITTSBURG, PA.

AUGUST 12, 1907.

The Oakland Board of Trade of the city of Pittsburg, in answer to your circular letter of invitation under date of July 1, 1907, most respectfully submits that it accepts with pleasure another opportunity of raising its voice in favor of the improvement of the Ohio River by a system of locks and dams from Pittsburg to Cairo.

The Board, as previously expressed to the Ohio River Improvement Association, Members of the United States Senate, Members of the House, and also to your predecessors, is now more than ever in full sympathy with the continued efforts again being made, and desire to emphasize the urgent necessity of the uninterrupted building of the dams successively, and most sincerely urge the very great importance of immediately deepening and maintaining the channel of that great waterway, the Ohio River, so that there shall be a continuous depth of at least 9 feet of water at all seasons of the year in said channel.

But what can we say to you that has not already been ably and forcibly said that will demonstrate more fully and clearly the inestimable importance of deepening and maintaining the channel as above asked for of that great natural water highway? We say, inestimable importance. Do you ask importance to whom? To the people of western New York? No! To the people of western Pennsylvania? No! To the people of West Virginia? No! To the people of Pittsburg, the greatest industrial city of the world, and one the Government, when needing help, never called upon in vain. Oh, no! No! The inestimable importance will be to the United States Government itself.

Our plea to you is not suggested from sinister or selfish motives nor our views of the importance of the improvements above referred to so narrow as to be confined within the States above mentioned.

However commercially important the Ohio River has been, is, and ever will be, to the people of western New York, western Pennsylvania, and West Virginia, distributed as they are over 18,000 square miles of fertile and productive agricultural and mineral territory, and for years affording commercial intercourse between those States, some of the most prosperous States of the Union, and which in connection with the Mississippi River, furnishes the only outlet by water for the commerce of those States to the sea, yet the commercial importance to those States and all others bordering on the Ohio River and its tributaries is insignificant when compared to the superlative importance it will be to the nation when the Panama Canal shall have been finished and opened for traffic.

The expenditure of the public funds by the United States Government or any other nation for the betterment, protection, and maintenance of its national road and water highways, is not only a great benefit to its people commercially, but also of far reaching importance to the Government in times of emergency.

The commerce now carried on the valleys of the Monongahela, Allegheny and Ohio is and has been steadily increasing year by year by such tremendous strides as to many would seem incredible, and is of such a character as may be urgently required by our Government when least expected. Would it not be well for this Government as a matter of public policy to put this waterway into the highest possible condition of effectiveness at once? Should the time ever come that the Government may require on short notice for use of her coaling stations or other Pacific possessions or dependencies the products of the mines and mills of the above-named valleys, and what is known as the Pittsburg district, the way will then be open for the delivery of the same to the Gulf of Mexico at least without breaking bulk and in quantities that it would be simply impossible to deliver by any other route so quickly. Would not this improvement be in harmony with the policy of internal improvements hitherto pursued by this Government? Would it not be good statesmanship and within the province of Congress to prepare for emergencies and for future as well as the present welfare of the nation, its interests, advantages, and protection? You have been or will be shown very shortly the immense tonnage now conveyed annually over the bosom of this great water course in its natural condition. Could you could anyone conceive today what the tonnage would be were the Ohio River kept continuously at a navigable stage of 9 feet of water from Pittsburg or Cairo? The possibilities are so very great that any estimate, however tremendous it might be, would more than likely fall far short of

what it will be in fact, when the improvements as prayed for will have been completed.

In asking favorable consideration for the improvement in manner and form herein requested we have the honor to subscribe ourselves, dear sirs,

JOHN DIMLING,
President of the Oakland Board of Trade.
JOSEPH PAINTER,
Chairman.
JOS. J. SINEHON,
M. J. EHRENFELD,
THOMAS S. BROWN,
B. H. HOLBROOK,
Committee.

The BOARD OF UNITED STATES ENGINEERS FOR THE OHIO RIVER.

LETTER OF THE PITTSBURGH (PA.) BOARD OF TRADE.

PITTSBURG, PA., *August 13, 1907.*

GENTLEMEN: This association, composed of 1,260 members, leading citizens and business men in the city of Pittsburg, respectfully submit the following brief memorial as an expression of the great interest felt by us in the making of a 9-foot channel in the Ohio River from Pittsburg to Cairo.

The Pittsburgh Board of Trade has been from the beginning of this movement to secure a 9-foot channel actively engaged in creating a knowledge of the importance of the improvement. In 1905 it had the chairman of the river and harbor committee as the guest of honor at its annual banquet; shortly after which event it largely aided the Ohio River Improvement Association in bringing the River and Harbor Committee to Pittsburg in the effort to have this matter fairly and favorably considered.

As an organization we are unanimously in favor of this improvement and have thus far and will continue to use all honorable methods within our power to have the same brought about.

We know that the members of your Board are men who have been in close touch with the improvements upon the rivers about Pittsburg, and that you are familiar with all the facts regarding tonnage, population, present freight congestion, etc., of this region, and, therefore we only desire to emphasize the fact that the members of our association believe that the deepening of the channel at present being constructed from 6 to 9 feet is a matter of the gravest importance at this ime.

The development of the district adjacent to the Ohio River is the most remarkable in our country and is undoubtedly destined to be upon the completion of this improvement and of the Lake Erie Ship Canal, more remarkable still. This valley drains a country richer in natural resources than any other district in the world. Pittsburg is now acknowledged to be "The workshop of the world," and with the improvement of its rivers its growth in the next few decades will be still more extraordinary. Mills and factories of all kinds will locate in the Ohio River Valley, where nature has already placed the greatest deposits of fuel—coal, oil, and gas—and where with ample water transportation all the year through they will have the advantages of shipping facilities that can not be surpassed on this continent.

The construction of a 9-foot channel will permit larger boats which can carry freight cheaper than smaller boats; it will permit the transportation of boats and barges of a size large enough for lake and ocean navigation, directly through from the Great Lakes to all points on the Ohio and lower Mississippi rivers.

Trusting that your Board shall in its wisdom see the unparalled need of the making of at least a 9-foot channel from Pittsburg to all the ports on the Ohio and Mississippi rivers, a channel which will permit us to carry our freight in unbroken bulk to the Gulf of Mexico, to the Panama Canal, and to the seaports of the world, we have the honor, gentlemen, to be,

Very respectfully yours,

PITTSBURG BOARD OF TRADE,
O. H. ALLERTON, JR., *President.*
J. R. PARK, *Associate Secretary.*

The UNITED STATES BOARD OF ENGINEERS ON RIVERS AND HARBORS,
Buffalo, N. Y.

LETTER OF THE MAYOR OF WHEELING, W. VA.

WHEELING, W. VA., *August 15, 1907.*

DEAR SIR: The following is a copy of resolution adopted by the council of the city of Wheeling, West Virginia, August 13, 1907:

RESOLUTION OF THE WHEELING CITY COUNCIL TO THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

Whereas the improvement of the Ohio River by the projects already begun is earnestly desired by the merchants and manufacturers of this city in order to cheapen transportation and to enable them to reach the markets of the country and the world at the lowest cost and by the quickest means; and

Whereas it has been amply demonstrated that the improvement of this great national highway would give an impetus to trade and manufacture in the Wheeling district, the good effects of which would be felt by all of our people: Therefore be it

Resolved by the council of the city of Wheeling, that we earnestly petition your honorable body to make a report favoring and urging the speedy improvement of the Ohio River by the system adopted, namely locks and movable dams, to secure and maintain a depth of 9 feet of water at all seasons of the year.

Resolved further, that a copy of these resolutions, signed by the Mayor and attested by the city clerk, be transmitted to the Board of Engineers for Rivers and Harbors, Col. H. M. Adams, Chairman, Buffalo, N. Y.

On motion the first and second branches of the council of the city of Wheeling unanimously adopted the above.

Respectfully submitted.

CHAS. C. SCHMIDT,
Mayor of Wheeling.

Attest:

CHAS. H. GEIGER, *City Clerk.*

Col. H. M. ADAMS,
Chairman Board of Engineers for Rivers and Harbors, Buffalo, N. Y.

Table showing depths for each month from 1902 to 1907, at Davis Island dam, with commerce reported.

[Submitted by Hon. James Francis Burke, Member of Congress.]

Month.	Stage.	Tonnage.	Above or below.
	Feet.		
1902.			
July	*15	1,123,999	Above.
1903.			
January	17	227,150	Do.
February	21	455,647	Do.
March	23	607,125	Do.
April	18	341,550	Do.
May	7	37,242	Below.
June	9	760,292	Above.
July	8	262,050	Below.
August	7	209,082	Do.
September	8	63,584	Do.
October	8	62,142	Do.
November	10	269,283	Above.
December	7	4,206	Below.
1904.			
January	27	137,324	Above.
February	17	127,575	Do.
March	24	795,611	Do.
April	21	743,088	Do.
May	11	580,551	Do.
June	8	85,339	Below.
July	10	273,959	Above.
August	3	294	Below.
September	3	419	Do.
October	4	825	Do.
November	3	200	Do.
December	12	239,536	Above.

*Rise anticipated.

Table showing depths for each month from 1902 to 1907, etc.—Continued.

Month.	Stage.	Tonnage.	Above or below.
1905.[a]	*Feet.*		
January	14	202,969	Above.
February	8	127,575	Below.
March	26	752,123	Above.
April	19	491,237	Do.
May	10	453,061	Do.
June	11	667,456	Do.
July	[b]10	407,719	Do.
August	9	141,873	Do.
September	7	93,007	Below.
October	12	321,311	Above.
November	13	181,139	Do.
December	21	560,977	Do.
1906.[a]			
January	17	264,623	Do.
February	6	1,500	Below.
March	13	445,325	Above.
April	17	448,789	Do.
May	8	16,397	Below.
June	12	372,090	Above.
July	5	2,150	Below.
August	10	322,375	Above.
September	5	310	Below.
October	7	84,494	Do.
November	12	551,157	Above.
December	16	598,464	Do.
1907.[a]			
January	21	117,918	Do.
February	11	9,869	Do.
March	34	567,052	Do.
April	11	402,414	Do.
July		405,403	Do.

[a] 1905–1907, average tons monthly, 397,474 above. 1905–1907, average tons monthly, 58,368 below.
[b] Not anticipated.

STATEMENT OF THE JAMES REES AND SONS COMPANY.

GENTLEMEN: In accordance with the public notice received by our firm of July 1, 1907, signed by H. C. Newcomer, Major, Corps of Engineers, we desire to submit our views as manufacturers of marine craft for inland waters, also as owners of such craft, the importance of having the Ohio River improved by canalization so as to give a navigable stage of 9 feet of water throughout the year. It would simply be impossible to estimate the great benefits derived and encouragement it would give to the further development of industrial enterprises throughout the extent of this great valley, and the use of the waterway, and by its terminals and relations to the different lines of transportation, in all directions, would be combining advantages unequaled in this country or, we might say, the world.

It has been estimated that the annual freight movement on the Ohio River is 12,000,000 tons, and with its eleven navigable tributaries 25,000,000 tons, and this with the river almost unimproved from what nature gave it, besides having artificial obstructions put across the main channel of the river, which has greatly curtailed the channel and impeded the safety of its navigation; also, owing to the cutting down of the timber along its banks and the watersheds which feed it, the rise and fall was much greater and the limit of its days of safe navigation lessened very materially, so that to utilize this great waterway in accordance with its needs at the present time it has become almost imperative upon the Government for its protection and in the interest of the people of the United States that it should be improved so as to give continuous navigation throughout the year, as it is not only the people of the States bordering on this waterway, but the people of the whole country, who will be benefited by the opening of the Ohio River as an avenue of commerce throughout the year.

It has been said that navigation on the river has deteriorated. Some changes may have occurred, but to no great extent. It was in 1811 that the first steamboat, the *New Orleans*, was built and plied upon its waters, the tonnage of

which was 40 tons, and every year it steadily increased, and in the year 1875 the steamboat *Paragon* delivered 1,450 tons of freight in forty-six hours from Cincinnati, on a 6-foot 4-inch stage of water in the river.

In 1854 the first stern-wheel towboat was built to tow coal to the lower ports. The capacity at that time was 25,000 to 30,000 bushels of coal for a boat, while at the present time it is about ten times that amount, and we frequently read in the papers of the great towboat, the *Sprague*, passing some of the lower ports on the Ohio River with over 750,000 bushels containing over 50,000 tons.

It may be true that some character of freight has grown less, and some deterioration in this kind of river transportation; but it has been because of the change in the location of the manufacturers along the different railroads that afforded switching facilities, and thus avoided the expense of hauling to the river, and now that those facilities are being curtailed and locations of that character getting scarce, and the great congestion that has occurred in the great freight-producing centers have again caused the people to look to the importance of having all the great natural waterways improved, that they may reap the benefit of this cheap and quick method of transportation; besides, by so doing it is the great regulator of freight rates to all parts of the country.

No one can foresee or foretell the future of the great advantage this improvement would make. We know that a continuous business could be maintained; that regular transportation arrangements would be made. New cities and new terminals along its banks would rise, and through these terminals connections made by new and the different railways to all parts of the country. New transportation lines put upon its waters of all kinds and descriptions not only reducing the freight rates to the different sections, but would afford great relief to the present railways that are now congested, owing to the lack of facilities to handle the accumulation of freight on the different branches and switches. New manufactures will line its banks from its headwaters to the mouth, which will require this waterway to move part of what it consumes and produces. In conjunction with this it may not be amiss to give you the difference in time of transportation that has occurred from McKeesport to Pittsburg within the last year, a distance of 12 miles, as it has been said that the transportation by water is much slower than by railroads, and on that account it is preferable to the shipper, which is a great error. It is very rare that a shipment by rail will reach city of Pittsburg from McKeesport under six days, and last year we had one shipment that took fifteen days from the day it was shipped until we received it, although we endeavored to trace same.

By steamboat a shipment was made at 9 o'clock, and in less than one and one-half hours it was on the wharf for delivery. A shipment made by water from Pittsburg to Cincinnati will reach the consignee in fifty-four hours from the time of the departure of the boat, and the consignee can always tell within a few hours when he will have his goods, and at the rate of freight fully one-third less than by railroads.

Therefore, taking the situation as it is, with the handicap put on navigation, we believe it is, and has maintained its own with the improved railroads in transportation of freight not only quickly, but cheaply, for the past fifty years.

We also believe history will repeat itself; and who can say that the Government may not at some future time be in great need of this great waterway for the building of light-draft war vessels, submarine torpedo boats, and torpedo-boat destroyers, as during the late civil war, and within the limits of this city monitors were built and sent by way of the Ohio and Mississippi rivers to the Gulf.

On the banks of the Ohio River and its tributaries in the State of Pennsylvania alone there exists structural manufacturers that have greater facilities for building and constructing these light vessels than the combined shipbuilding interest of the Atlantic coast and in case of emergency could be used for this purpose, and by the improvement of the river and the connection with the Great Lakes by the canals now contemplated or under construction it would afford to the Government the means of transporting these vessels to the lakes or to the Gulf and seacoast at will, thus affording another great protecting arm for its defense in time of need, far away from the danger of the guns from the fleet of the enemy and almost at the doors of the manufacturers which produce the materials to build these vessels: cost of plants complete estimated at $30,000,000.

At the same time we deem it of great importance for the protection of this great waterway when improved that through the Government the different

States, counties, cities, and boroughs should be compelled to protect the approaches, so that facilities may be afforded the people to reach the river, as we find the railroads, by having right of way and the use of eminent domain, along the natural waterways are destroying these approaches and it will become impossible to reach the river without trespassing on the vested rights of these corporations, which will be a great detriment to the free use of this great highway, and that some protection should be given to the banks between the high and low water mark that will be permanent and a benefit to the public in the future.

We believe it only needs the canalization of this river to demonstrate the mighty industrial and financial benefits that must inevitably follow, as the great industrial enterprises that have been constructed and in course of construction for the past three years give a faint idea of what is forthcoming in the future when the river is placed in condition to be utilized throughout the year.

The Jones & Laughlin Steel Company, who transport the coal from their mines 50 miles up the Monongahela River, passing through three locks at a cost of 4 cents per ton, are now, owing to the present improvement made by the Government, erecting a very large addition to their already very large plant on the banks of the Ohio River, 18 miles below the city of Pittsburg, to be in operation by March, 1908. The consumption of fuel for this new addition is estimated at 1,600 tons per day, and it is contemplated that 2,000 tons per day of the production of this plant will be transported by the improved river, to their plants located in this city. They also have under contract towboats and barges to move the product of their mines and furnaces for this new plant, which will require a stage of water of over 8 feet to allow free and uninterrupted passage to and from their mills and mines.

It has been universally conceded by marine architects and navigators in this country and in the old world that our system of navigation and the immense tonnage we are able to handle with our powerful towboats on our western rivers, is unexcelled in any part of the world, and after an investigation by many prominent engineers and navigators it has been recommended for India, Asia, Africa, and South American waters, and within the past year Mr. John Ward, managing owner of Denny & Sons, of Dumbarton, Scotland, one of the very largest shipbuilding plants in that country, was called upon to build one of our Western river stern-wheel steamboats for India, having received the report the engineers made of their visit here, investigating the method of transportation on our rivers. He thought it was impossible for river craft to do what it was claimed, and that it was impossible to transport freight by water as cheaply as given him, and that it was simply impossible to navigate on our rivers safely and cheaply if there were artificial obstructions in the river, as reported.

He came to America on his vacation to spend a week or perhaps ten days, and one day was to be a visit to Pittsburg. We were notified of his coming, and we arranged to show him all that was possible in Pittsburg in one day in regard to boats and navigation, and when he came he visited our boats, traveled on our towboats, and was up the river and down the river. In fact, his visit was over seven days in Pittsburg, and when he left he remarked: "When I came I thought it incredible, but I saw for myself and am convinced it is marvelous. I can not carry it all with me, and I will come again. Your boats and methods of navigation are far ahead of anything I could conceive, and when the river is improved, as your Government is now doing, what a great and prosperous country it will be along its banks."

The Government through its very able Corps of Engineers has demonstrated by the building of Davis Island dam and those now almost completed between Pittsburg and the mouth of the Beaver what can be done to give uninterrupted navigation, and manufacturers are seeing what great advantage it is and will be if improved as it is contemplated it will be.

The different packet lines which are now unable to have their boats reach the city will be able in the best and most prosperous season of the year to complete their trips and afford to the tourists and people who desire to seek a few days vacation for health and pleasure at very little expense above what they are now paying for board a ride on the Ohio River, the scenery of which is unexcelled by the Rhine or Danube.

We therefore request in the name of the people of this great country that you will report to Congress the importance of having the Ohio River improved

so as to give an uninterrupted stage of water of 9 feet from Pittsburg to Cairo, at its mouth at as early a date as possible to complete same, by the people, for the benefit of all people.

Respectfully submitted for your consideration.

JAMES REES AND SONS COMPANY,
T. M. REES, *General Manager.*

The BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

SUPPLEMENTAL STATEMENT OF THE JAMES REES AND SONS COMPANY.

GENTLEMEN: Having submitted a paper at the public hearing held in Pittsburg, Monday, August 12, 1907, we desire to submit additional matter on the subject, as we deem it important that some few facts omitted in the previous paper be now submitted on "navigation," its perils and expense in holding vessels for use in the river, which is a heavy tax on the navigation interest and the consumer in the end.

The present method in holding coal in the harbor until the water rises sufficient to transport same to the lower markets requires at least an investment of fully 50 per cent in barges or floating craft more than would be required if there was uninterrupted navigation by low water. These crafts are loaded and held in the various landings, which usually averages, almost every year, from four to six months, and we have known barges to be in landings over seven months. One great item of expense in connection with this is the lines required to hold same, which has been estimated as thirty coils of 2-inch diameter manila line for every 100 barges, held every six months, as the water is impregnated with acid and minerals, which makes the lines utterly worthless in six months for holding barges, and it is an expense to try and save same, when a little rain falls, by taking them in and then putting out again.

The cost of holding barges and boats in the landing and pumping same is $15 for barges holding 15,000 bushels of coal and $25 per month for boats holding 25,000 bushels of coal, and when there is any great amount of pumping required by a boat leaking badly there is a charge for extra pumping. It can be safely said that it will average over half a cent per bushel held every year, during low water, and the amount held every year will average fully 10,000,000 bushels.

The transportation of coal at present is very dangerous, as rises in the river are very spasmodic, and when sufficient water comes to allow the coal to go out, the harbor being full of towboats in all the various landings, and hitched to their tows, they start out, and by the time they are well under way they will be found so close to each other that it is simply impossible to avoid collisions, and much loss of property occurs. Besides, an accident befalling one of the boats in the lead precipitates other accidents to boats following so close, as it is impossible to avoid the danger in front, and quite frequently a loss from $10,000 to $15,000 occurs, and this loss of property does not always occur without entailing a loss of life or maiming for life one or more of the crew on the boats and barges.

We have known of several rises in the river, when the harbors were congested by numerous boats and barges, of boats breaking loose above and sweeping down on those below and entailing a loss of over $150,000 in less than one day.

This dangerous congestion of the harbor would cease entirely with the canalization of the river, giving an uninterrupted navigation of 9 feet, and would reduce the existing danger very materially to all floating craft, as there would be no necessity of barges being held in the landings and crowding up the harbor so that it is almost impossible to pass. The coal would be transported regularly, making at least four and five trips to one that they now make, and it would also avoid the necessity of going out on high water with excessive tows, and would thus avoid the dangerous cross currents in passing through spans of the very many bridges now obstructing the free and easy navigation of the Ohio River.

The cost of towboats to transport barges to the lower markets could be reduced in cost fully 25 to 40 per cent, and the reduction in the running expense would be fully 20 per cent. Also the consumption of fuel used on these boats would be reduced from 25 to 40 per cent, as it has been found that in the

ordinary stage of water, of 10 to 12 feet, that the towboats of 18 and 20 inches diameter of cylinder are quite capable of handling all the barges that should be put on a boat to navigate between Pittsburg, Cincinnati, and Louisville and are more successful than those of 22 and 24 inches diameter of cylinder, as it is only when the river is at its highest stage and increased current and they are compelled to rush the taking out of coal to reach the markets and taking the additional risk that the larger boats have any advantage due to their increased power.

There can be no question whatever as to the coal towing trade, if the river was improved, that it would not only be a great saving of capital and labor and general expense, but would very materially reduce the cost of fuel to the consumer, and would also greatly reduce the danger of loss of life and property.

The same may justly be said in regard to the freight and passenger trade. Every landing, city, mill, and manufacturer established along the banks of the river and terminals could rely on receiving freight regularly and almost at a stated hour when the boats would land. The traveling public could therefore be accommodated with ease and comfort, so they could secure rest and recreation at will at any season of the year, as the expense of the boats would be less in proportion to the increased receipts. Capital could be insured a profit on the investment. The danger of rubbing and breaking of the frame, timbers, and the bottom of the vessels would be lessened, so that instead of an annual tax of 10 to 15 per cent, as now exists regularly, on the cost of the vessel it would be reduced to 2 or 3 per cent. The cost of the annual expense in salary paid to the crew and officials of the various companies would be fully 6 to 10 per cent saved to the vessel owners on their investment at the present time, which is a constant and annual loss to every company now in the transportation business on the Ohio River, owing to the lack of water to give uninterrupted navigation for more than six months in the year.

As we have previously stated, June, July, and August to the freight and passenger trade are worth more than all the balance of the year, as these months are their harvest, and to suspend for a few months during the best season of the year is a hardship and tax on vessel owners that they have been hoping to be relieved of for over twenty-five years, as the establishment of Davis Island Dam raised their hopes that the Government—who had so long neglected the inland waterways—would now speedily improve it, so it could be utilized to its full extent.

The suspension of navigation, diverting the trade to other means of transportation, means considerably more than the time navigation is suspended, as it takes days and months to have those that would like to patronize and prefer the water transportation to again give part of the trade to the river. Some of the shippers have been severely punished by the railroads for so doing, as they have many ways of inflicting punishment, such as classifying, withholding cars, delivering, etc., that makes it unpleasant for them, all of which would not occur if navigation would not be suspended.

It can be truly said that the life and soul of the navigation interests of the Ohio Valley are now depending on the canalization of the Ohio River to give 9 feet of water from its headwaters to its mouth, as it is impossible to retain capital in a line of business that remains idle so long and preventing a just and proper return simply because they are not able to use the natural waterway owing to lack of sufficient water.

We referred in our previous paper to the use that could be made when the river is improved—in case the necessity might arise—to the building of light war vessels, and we will submit you herewith the draft of some of these vessels.

The draft of torpedo boats like the *Talbot* and *Gwin* when complete, ready for service, is 5 to 6 feet.

The maximum draft of torpedo-boat destroyers is 7 feet 8 inches.

The draft of the second-class battle ship *Indiana* was 9 feet 9 inches, without machinery or guns, when launched.

The draft of light-draft cruisers, like the *Nashville*, when launched was 7 feet 6 inches forward and 9 feet 6 inches aft.

Therefore, when the river is improved at no time would it be impossible to not float any of the vessels above named to the mouth of the river, where guns and machinery could be installed.

Hoping we have not intruded too much upon your valuable time, and if there is any further information desired on any subject pertaining to navigation, cost

of vessels, etc., on the Ohio River, we will be pleased to give you all within our power.

Yours, respectfully,

JAMES REES AND SONS COMPANY,
T. M. REES, *General Manager.*

The BOARD OF UNITED STATES ENGINEERS FOR RIVERS AND HARBORS.

STATEMENT OF B. F. JONES.

GENTLEMEN OF THE BOARD: I did not expect to be called on, and therefore have no prepared speech.

The necessity of additional transportation facilities to the manufacturer is becoming more apparent each day. The railroads of this country did not realize the vast growth of the manufacturing interests at first, and when they did realize it the increase in production had gone so far beyond their carrying capacity that with their very best efforts they have been barely able to keep ahead. Every plant in this district and other parts of the country is increasing its production daily, and some method must be discovered to take care of this added production. I am informed that where canals have been built in competition with railroads the increased transportation facilities instead of reducing the revenue of the railroads have increased it. Canal transportation is not intended for the finer grades of material, but is confined to the material of large bulk and comparatively low value. This kind of material can be taken care of much better by canal transportation than it can by railroad.

One other point we of Pittsburg district and the Ohio Valley must take into consideration—that to-day great plants are being built at the lake shore, where ore can be delivered directly from the boats to the furnaces, materially reducing the cost. To hold the supremacy, of which we are so proud, this district must have some way of getting their raw materials, if not as cheap, at least more nearly so than the rates are to-day paying, and the 9-foot stage is a step in that direction.

STATEMENT CONCERNING THE WEALTH AND PROSPERITY OF THE WHEELING DISTRICT.

[Furnished by the Wheeling (W. Va.) Board of Trade.]

The Wheeling district is one of the most prosperous and progressive communities in the Ohio Valley, and its interests will be most materially aided by the improvement of the Ohio River. Wheeling merchants and manufacturers keenly realize the advantages to be gained in the way of lower rates and improved transportation facilities by waterways navigable all the year round and have actively and energetically supported the propaganda of the Ohio Valley Improvement Association. They have given freely of their time and money to aid this cause and to impress upon the Government the importance of improving this great natural highway so that it could be used every month in the year. The representatives of our people in Congress have ably reflected our sentiments on this question, and it is our earnest hope that the work which has been so well begun may be pushed to completion.

A few facts regarding the wealth and prosperity of our community and the claims it makes for consideration in the proper solution of this question may be set down here for the information of your honorable body.

The Wheeling district embraces the city of Wheeling, of nearly 50,000 people, and the tributary suburbs within a radius of 20 miles in West Virginia and Ohio. The suburbs include Wellsburg, Benwood, McMechen, and Moundsville in West Virginia; and Mingo, Brilliant, Martin's Ferry, Bridgeport, Bellaire, Barton, and St. Clairsville and other towns in Ohio. These are all connected with Wheeling by trolley, and the whole system will aggregate about 130 miles.

Bulletin No. 44, Census of Manufactures for Virginia and West Virginia, issued last year, give some idea in figures of the prosperous condition and steady growth of our industries. The statistics given in this document cover the first half of this decade and show that between 1900 and 1905 the number of Wheeling's establishments increased from 178 to 196, or 10 per cent; capital invested, from $12,274,707 to $18,227,622, or 48.5 per cent; wages paid, from $2,678,530 to $3,842,659, or 43.3 per cent; cost of materials used, from $8,405,903

to $13,806,723, or 64.3 per cent; value of products, from $15,074,345 to $23,297,475, or 54.6 per cent. This record of growth and achievement is for Wheeling alone; the figures for the whole district would more than double them.

Our interests are diversified and our manufacturers turn out a great variety of products, but the iron and steeel, coal, glass, tobacco, and pottery industries are well in the lead.

In the iron industry alone about 17,000 men find employment in Wheeling and its suburbs. The concerns include such large and prosperous independent plants as the LaBelle Iron Works, the Wheeling Steel and Iron Works, and the Whitaker-Glessner Company, while the United States Steel Corporation has large concerns at Mingo, Martin's Ferry, Bellaire, and Benwood. It has been estimated by a careful canvass that the iron and steel mills of the district have a daily capacity worth at least $275,000, with a daily pay roll reaching almost $100,000.

The mining industry, which has been so signally aided by waterways, flourishes in the Wheeling district. Within a radius of 20 miles of Wheeling, on both sides of the river, there are a score or more of mines which employ over 13,000 men. Much of this coal is used in our local industries and a great deal shipped to lake ports and other points. There are still many acres of coal lands in this section untouched, which would be vastly benefited by open navigation all the year round.

The Wheeling district has a dozen large glass plants, turning out products that go to all parts of the country. Two of these are among the largest in the United States. Nearly 4,000 persons find employment in these plants.

The tobacco industry has always been a large one in Wheeling, which justly lays claim to the honor of being the home of the stogie. Three of the largest concerns in Wheeling give employment to nearly 1,300 people, while several hundred find employment in smaller factories.

The pottery industry has grown to be an important one, and Wheeling wares find ready sale in all domestic markets and at some foreign points. In the four large plants in the Wheeling district about 1,200 people are employed and the business is growing in extent and importance.

Aside from these Wheeling industries the Wheeling district boasts many others. For instance, we make the sacks for Pillsbury's flour. We make tools for the Panama Canal. We make casing for the East River tunnel. We have one of the few tin can companies outside of the tin can trust. We have bridge works which sell their products as far apart as Alabama and Maine. We make metal ceilings that go everywhere. We turn out leather and calico, that are staples in these markets and have been for fifty years. We have packing houses, preserving plants, stamping works, breweries, and a host of other industries which do a thriving business and which attest the advantages that manufacturers may find here. According to expert estimates our annual tonnage in and out runs to 5,300,000 tons, or over 252,000 cars.

Our commercial importance is reflected by fourteen solid banks with an aggregate capital of $2,387,000 and deposits of $22,000,000 in round numbers. The total volume of banking business has doubled in the past six years. Our clearings have steadily increased and last year reached the total of $53,000,000, an increase of 30 per cent over 1905. The average daily clearings increased from $108,351 in 1901 to $170,052 in 1906.

Wheeling is the commercial center of the State, and its wholesale trade will aggregate $25,000,000 annually and its retail will run about one-half that sum.

That all of our manufacturing and commercial interests would be benefited by river improvement can not be doubted. It would mean lower freight rates, quicker service, and consequently increase trade and traffic. In the cheap transportation of manufactured articles and the expeditious assembling of raw materials it would prove a tremendous advantage to our merchants and manufacturers, and the beneficent effects would be felt by everyone in the community. The volume of business on waterway and on railroads as well would be increased many fold by the additional impetus given to our trade by river improvement.

It has been set forth in this paper how much Wheeling has done in five years. With the Ohio River navigable all the year the figures given would in a short time look small and our present boasting seem vain.

R. B. NAYLOR,
Secretary Wheeling Board of Trade.

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